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AIR QUALITY IMPLEMENTATION PLANS

Proposal of Stage II Vapor Recovery Regulations and Test Procedures

ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 52]

APPROVAL AND PROMULGATION OF INDEPENDENT PLANS

Reproposal of Amendments to Stage II Vapor Recovery Regulations and Test Procedures and Notice of Public Hearings

Section 110(a)(1) of the Clean Air Act, as amended, 42 U.S.C. 1857c-5(a)(1), requires each state to submit a plan for the "implementation, maintenance, and enforcement" of the national primary and secondary ambient air quality standards. In order to correct deficiencies in certain plans pursuant to section 110(c) of the Act, the Administrator promulgated Transportation Control Plans designed to reduce ambient levels of certain automobile related pollutants including hydrocarbons and photochemical oxidants. As part of the plans for sixteen air quality control regions (AQCR's), regulations were promulgated which required the recovery of ninety percent of the vapors (by weight) displaced during the filling of gasoline storage tanks (Stage I vapor recovery). For thirteen of these AQCR's (Baltimore, Boston, Denver, Los Angeles, New York-New Jersey-Connecticut, Philadelphia, National Capital, Houston-Galveston, Dallas-Fort Worth, San Antonio, El Paso-Las Cruces-Alamogordo, Sacramento Valley, and San Joaquin Valley) or portions thereof, regulations were also promulgated for the recovery of gasoline vapors from the motor vehicle refueling process (Stage II vapor recovery). A revised plan for the Dallas-Ft. Worth AQCR will be available shortly. Those regulations also required ninety percent recovery (by weight), but specified no test procedure for determining compliance. In order to correct that deficiency, to provide less stringent requirements for dispensing facilities with smaller gasoline throughput and to guide owners and operators as to their responsibilities with respect to maintenance and operation of vapor recovery systems in the field, amendments to the Stage II regulations were proposed on October 9, 1975, in 40 FR 47668. A 45-day public comment period was established and was subsequently extended to December 29, 1975. See 40 FR 54436. Over two hundred comments on the October 9 proposal were received, primarily from oil companies, oil jobbers, gasoline marketers, and service station owners and operators. An analysis of these comments by the Agency and certain recent developments such as the evolution of a short test procedure and the certain amendments which may be made to the Clean Air Act have led the Agency to reevaluate the October 9 proposal. As a result of this reevaluation, the Agency has concluded that a basic change in the enforcement and implementation strategies previously proposed is appropriate and herein proposes regulations incorporating these new concepts.

The Certification Strategy

The October 9 proposal would have required facility owners to install a vapor system which had previously been certi-recovery system which had previously been certified by EPA. The Agency would have evaluated a system's performance and durability characteristics and approved the system if those characteristics were deemed satisfactory. Although a certification approach diverges significantly from the Agency's usual practice of setting an emission standard which must be met in the field and would place the Agency in the unusual position of evaluating and endorsing specific emission control equipment, the approach was advocated for two reasons. First, the available test procedures did not readily lend themselves to the extensive field enforcement necessary to assure widespread and continuing compliance with emission standards. It was felt that requiring the installation of previously evaluated systems would provide the necessary assurance that facilities were generally in compliance without actually performing emissions testing on the installed systems individually. Second, the Clean Air Act imposed a May 31, 1977, deadline for attainment of the national primary and secondary ambient air quality standards which effectively precluded allowing a long period of time for evaluation of various existing systems, particularly for smaller business organizations. Although the Agency remains convinced that systems exist which can meet the emission standards at reasonable cost, a facility owner's selection of individual systems in the marketplace would have involved some guesswork, due to the limited field experience. Certification would have permitted a more rapid, systematic, and consistent evaluation of equipment. A certification program also would have provided a basis for small businesses to select a vapor recovery system. While very large organizations might have the resources to fully evaluate several different systems prior to installation, smaller organizations would not. Certification results would have provided a basis for the small businessman's selection of a particular system.

The In-Use Strategy

Certain amendments which may be made to the Clean Air Act and the development of a short test procedure combine to provide the necessary flexibility to permit the Agency to adopt an enforcement and implementation strategy more in line with the usual concept of an "emission limitation" under section 110(a)(2) of the Act. The proposed regulation requires installation of vapor recovery systems according to a phased schedule, with the major integrated oil companies beginning installation first, and with smaller organizations beginning installation in subsequent years. An intensive field testing program will be conducted by the Agency during the "phase-in," and the results of this testing will be made public. The evaluation program will be patterned after the Agency's unleaded fuel program in which a percentage of all affected facilities are tested each year. The Agency will not wait until the first compliance deadline to begin the inspection program, but will begin testing systems presently installed or installed prior to the beginning of the phase-in period. Of course, no sanctions will be imposed for "failing" a test prior to a compliance deadline. These results will be used to provide information as to system performance for the smaller organizations which must begin installation in later years. The major oil companies have the necessary resources to conduct their own development or evaluation programs, and in several cases have already done so. Most organizations are given a number of years to install systems at all their facilities subject to the regulation in order to allow time to raise the necessary investment capital and to further evaluate technology. Field testing would involve use of the short test procedure proposed herein. This approach will accomplish the goals of the certification program and will provide greater assurance that systems continue to meet the emission standards in the field.

Compliance deadlines are specified according to the economic classification of the facility's owner. A facility will be designated a Class A facility if the owner is considered to be a Large Integrated Refiner as defined by the Federal Energy Administration. Large Integrated Refiner means "a refiner which obtained directly or indirectly, in the third quarter of 1973, less than 70 percent of its refinery input of domestic crude oil (or 70 percent of its refinery input of domestic and imported crude oil) from producers who do not control, are not controlled by, and are not under common control with such refiner." (Reference: "Petroleum Market Shares—Historical Report on Refiners and Importers of Motor Gasoline," 1972 through 1974, Federal Energy Administration, FEA/B-75/616). Class B facilities will include all retail facilities not included under Class A. Lastly, all facilities which dispense gasoline for nonretail purposes will be designated as Class C facilities. All facilities with an annual throughput of less than 120,000 gallons are exempt from the regulation.

Under the proposed phase-in program, each Class A owner will be required to complete installation of vapor recovery systems by December 31, 1977, at twenty (20) percent of its facilities in each affected AQCR. This date is predicated upon promulgation of the final regulation by March 1, 1977. By June 30, 1979, Class A owners will be required to have the remaining eighty (80) percent of their facilities in compliance.

Class B owners will be required to complete installation of vapor recovery systems at the largest one-third of their facilities in each AQCR by June 30, 1979.

The second largest one-third of the Class B facilities must be in compliance by June 30, 1980, and the smallest one-third by June 30, 1981. Finally, all Class C facilities must be in compliance by June 30, 1979.

If an owner has an odd number of stations such that a fraction of a station would have to be completed in a given year, the fraction will be rounded so that the extra facilities will be installed in the earliest years. For example, a Class B owner with five stations will complete two by June 30, 1979, two more by June 30, 1980 and the last by June 30, 1981.

The phase-in approach is believed to be reasonable because it eases many of the technological and economic problems associated with the regulation. The schedule allows for the technology to be installed at a relatively small number of facilities at the outset so the systems can be tested and evaluated in order to determine which systems will meet the emission limitation. Only companies believed to have the technological expertise to assess the feasibility of various systems are required to install the equipment in the first 18 months. The phasing of the regulations over a number of years for all owners allows small businessmen time to acquire the necessary capital to finance the equipment while minimizing the competitive impact that could result if all facilities were not phased in over roughly the same time period.

The Need for Further Emission Reductions

The need for maximum hydrocarbon controls in each affected AQCR is well established by data published in EPA Document No. 450/3–75–046–a and in the preambles to the original regulations. From these data, it is clear that maximum recovery of hydrocarbons is needed to comply with the National Ambient Air Quality Standards in the designated AQCR's.

Certain issues relating to the need for vapor recovery regulations have been raised previously in public comments. These issues include the appropriateness of the National Ambient Air Quality Standards for hydrocarbons and photochemical oxidants and the relationship between hydrocarbon emissions and the formation of exidants. The Agency suggests that comment on these points not be submitted in response to this rulemaking proceeding. Nevertheless, the Agency will continue to review these issues in other contexts and requests that any new scientific information and data on these matters be submitted separately to EPA's Environmental Sciences Research Laboratory in Research Triangle Park, North Carolina, for analysis.

Emission Standards

A number of the comments on the October 9 proposal suggested that EPA retain a percent by weight standard in lieu of the mass standard which was proposed. The possibility was noted that under certain weather conditions the original goal of 90 percent control could be achieved while failing to meet the proposed 0.4 gram per gallon limit. Others pointed out that uncontrolled emissions have been reported ranging from less than 3 to over 5 grams per gallon.

EPA has examined the pros and cons of both mass limitations and percent control requirements and has determined that a mass limitation is the most appropriate form for the emission limit. In addition to being consistent with other types of air pollution control regulations and with the need to directly limit emissions, compliance with a mass standard does not require that potential uncontrolled emissions be measured. Potential emissions are difficult or impossible to determine for certain types of control systems, and are not measured with the proposed direct measurement test method.

Testing conducted by the Agency and other organizations indicates that there are several systems capable of meeting the 0.4 gram per gallon emission limit. However, most of these tests were conducted with restrictions that will not be duplicated during surveillance testing. Because of the uncertainty of system performance under wide-ranging conditions, the lack of data on uncontrolled emissions, and the nascent form of the short test, a specific mass standard is not being proposed. Instead, the Agency is choosing to indicate that the final mass standard is expected to be within the range of 0.4 to 0.6 gram per gallon. Further testing will be performed with the short test prior to the promulgation, of this regulation, and the submission of the test data from the industry and local agencies is encouraged on this matter. The standard will represent the maximum allowable emissions from Stage II operations at an individual station when fuel is dispensed to a sample of vehicles representative of the on-the-road light-duty vehicle and truck population. The limitation will apply at all times regardless of ambient temperature and in all marketing variations (i.e., both attendant-serve and self-serve modes).

The proposed standard also contains a limitation on the amount of spillage permitted. Spillage would be permitted to occur in up to 15 percent of all vehicle refuelings, an increase over the five percent permitted in the October 9 proposal.

Since the October 9 proposal, additional data have supported the Agency's conclusion that the proposed emission standards are achievable at reasonable cost. Results of tests conducted by the Agency to evaluate the new short test procedure indicate that emissions from the vehicle-nozzle interface, the major emission point, were less than half the 0.4 gram per gallon standard for two vacuum assisted and one hybrid system tested. The balance system tested exceeded the standard by a small margin. However, the balance system used nozzles which did not incorporate a "no seal-no flow" device or other refinements generally considered necessary to achieve a high percentage of vapor-tight fits. Several major oil companies, including Exxon and Texaco, have indicated that balance systems incorporating such refinements are capable of meeting the emission standard. A report on the above testing is available from the Director, Mobile Source Enforcement Division (EN–340), U.S. Environmental Protection Agency, 401 M Street SW., Washington, D.C. 20460. The Agency will be conducting in the near future complete tests using the short test and the proposed sampling plan and measuring emissions from all points at a facility. Results of this testing will be made available prior to the public hearings announced below.

The costs associated with the installation and operation of a vapor recovery system vary with the type of system. Because there has not been a large market for these systems, it is not possible to accurately portray the eventual market costs of these systems. Most of the cost data that have been generated up to this point results from one-at-a-time system purchasing. These costs should decrease considerably when a competitive market becomes established and systems are purchased in larger lots. An example of the latter is the cost of the balance system. In the October 9, 1975, proposal, costs for this system were estimated to be in the range of $6,000 to $8,000 for a 50,000 gallon per month station. One oil company that has installed underground piping for Stage I and Stage II on a larger scale recently informed the Agency that their costs were less than $3,000 per station. For hybrid and vacuum assist systems, another factor that will reduce costs in later years is the write-off of research and development costs in the early years. One manufacturer has indicated that in their estimation, the unit cost will decrease by 50 percent after this write-off. In general, hybrid systems (including aspirator and simple burner systems) may cost approximately $1,000 to $2,000 per station more than a balance system.

Maintenance costs for all systems will be dominated by nozzle repair and replacement costs. Since the faceplate and bellows are subject to considerable abuse, they often require maintenance before the nozzle mechanism normally would. This is an especially initial concern for the balance system since a leak at the nozzle is not as important in hybrid and vacuum assist systems where a negative pressure exists at the nozzle (resulting in an inward flow of air and vapor). Vapor recovery nozzles are more expensive than regular nozzles, and faceplate and bellows repair kits are not inexpensive. We anticipate that these costs will also decrease with an expanding market since rebuilders may be induced to enter it. It is expected that hybrid system maintenance costs will be approximately the same as balance system maintenance costs. Although there are additional parts that require maintenance, they are relatively few and simple and their maintenance costs may be offset by the lower level of nozzle maintenance that may be required. Vacuum assist maintenance costs will probably be higher. There is very little documentation or comparative maintenance costs so the above discussion is somewhat

speculative. Commenters are encouraged to provide this data when possible.

The regulations also prohibit any supplier of gasoline from delivering fuel to a facility which has not installed a vapor recovery system by the facility's applicable compliance deadline. The supplier is neither required nor authorized to make any evaluation of the quality of the installed system, but is merely expected to observe the existence or absence of some emission control device (e.g. by observing a vapor return hose from the dispenser nozzles). Information on the applicable compliance date for individual facilities will be made public so that suppliers can determine their obligations under this provision. The Agency feels that this provision is appropriate, since the operation of a facility without a vapor recovery system after its applicable compliance date is an unlawful act, and by supplying the means to perpetuate the unlawful act, the supplier in effect becomes a participant therein.

TEST PROCEDURES

Three test procedures are included in this proposal, a combination baseline/leak-rate procedure applicable to balance systems, a combination explosimeter/direct measurement procedure applicable to assist systems, and a short test procedure. This latter technique is capable of measuring emissions at the vehicle fill neck without regard to the type of nozzle or control system in use. One of these proposed test procedures will be promulgated. Since almost all of the emission testing to date has been done with the baseline procedure, the leakrate procedure, or the combination procedure, the data now available is based on the results obtained from these tests and various laboratory tests. If there is a significant variation between the emission values obtained by these tests, the measurement differential will be resolved prior to the promulgation.

In the October 9 proposal, three balance system test methods were presented for comment: a base line method, a leak rate method, and a bag technique used for volume measurements. A large number of commenters expressed a general preference for the leak rate method rather than the base line method. However, many of these suggested also that the leak rate method be limited for use only where small leaks occur. This would be accomplished by combining the base line and the leak rate procedure. Few commenters supported the proposed bag technique as an alternative procedure for use in the base line method and this method is, therefore, not included in this proposal.

Based upon these comments and an analysis of the data, EPA has concluded that the base line method produces accurate results when averaged over a number of vehicles. We conclude also that the leak rate method, at least for smaller leaks, produces accurate results which are more precise than base line results on an individual vehicle basis. However, for larger leaks there is some question as to whether the leak rate method is accurate. Data are not available to determine conclusively whether this is a problem and, if so, whether the problem is inherent in the method or caused only by the use of inadequate equipment. However, because of the inherent difficulty in accurately measuring very low pressures and in establishing accurate leak rate versus pressure relationships when the pressure differential is near zero, both of which are necessary in the leak rate method, the potential for imprecision and inaccuracy exists. On the other hand, the precision of individual base line method determinations is independent of the size of the leak or the inability to precisely know the potential emissions for each test vehicle. As a result, the base line accuracy when expressed as a percentage of true emissions, improves with larger leaks.

Therefore, a revised method has been developed and is now being proposed which combines the leak rate and the base line methods. The basic procedures which were proposed for each method are now combined and are performed on each vehicle with the exception that no predetermination or force fitting of base line cars is required, and the leak rate calibration is performed after the vehicle is refueled. Vehicles where no leak occurs (as determined from the leak rate procedure) are used both as test vehicles and for calculating the base line; emissions from vehicles which leak 0.8 gram per gallon or more (as determined from the leak rate procedure) are determined by the base line procedure.

When applied to 100 or more vehicles, the repeatability of this procedure is good. Analysis of data from duplicate tests, submitted by Scott Environmental shows the average standard error for single base line measurements to be about 0.7 gram per gallon. For fleets of 100 and 500 vehicles, this reduces to 0.07 and 0.03 gram per gallon, respectively. Since the leak rate method is more precise, the precision of the combined method will be greater.

With respect to the vacuum assist test procedure proposed on October 9, a frequent comment concerned the use of the explosimeter as an indicator of leakage at the fill neck nozzle interface. EPA is aware of the potential deficiencies of the explosimeter. Nevertheless, a review of available data shows the explosimeter to be an acceptable tool which can be used to detect excessive leakage when vacuum assist systems are used. Use of the explosimeter assures that significant leaks are not ignored while at the same time not rejecting systems which have efficient capture. The procedure is therefore being retained in this proposal. However, depending upon comments received and any further data, the Agency may replace the explosimeter technique with the sleeve device now being proposed in the short test procedure and described below.

A new short test procedure was developed to permit the Agency to perform in-use surveillance of Stage II vapor recovery systems. Even prior to the October 9 proposal, it was realized that none of the existing test procedures would be practical for surveillance testing. A second concern that guided the short test development was that existing test procedures did not measure the emissions directly. Rather, they relied on indirect determination through statistical relationships. It was felt that if the hydrocarbon losses could be measured directly, controversy over the specific technique used to indirectly determine the emissions would be eliminated.

The procedure proposed here directly measures the leaks at the fillneck by using a sleeve enclosure around the nozzle to draw a slight vacuum at the nozzle. The volume of the air stream and the average concentration of the hydrocarbons can be determined directly. At present the test can be conducted by two persons and the test equipment can be used at any number of dispensers, limited only by the length of the vacuum line. The test time for each individual vehicle refueling and the amount of raw data collected are minimal. The underground tank vent and secondary processing unit (if present) are monitored as in the combined test, by carbon canister, or by the sleeve. Each will be tried by further testing.

Some concern has been expressed that the sleeve device will interfere with the ability of the nozzle to achieve a tight fit with the fillneck, that the vacuum will draw vapors into the sleeve that otherwise would return down the vapor return lines, that the sleeve will not be able to be used on all cars, and that the results of this test procedure will not compare with previous test procedures. The sleeve was expressly designed so it would neither interfere with the nozzle nor induce any vapors to leak from the interface when they ordinarily would not. The sleeve is designed to create a neutral environment around the fillneck interface (i.e. there will be no wind effects) and to capture the vapors that would normally escape to the atmosphere. Testing conducted to date has uncovered only two vehicles which did not permit the use of the sleeve (Reference 1). These vehicles represent a negligible portion of the vehicle population. The use of the short test should not invalidate the large amount of testing with the procedures which have preceded this proposal. Additional testing will be conducted to determine complete system emissions using this test procedure in both controlled and uncontrolled situations. Sleeves will be distributed to those companies which have previously conducted tests so that they can both evaluate and compare the sleeve with respect to previous test procedures. As further data is accumulated, it will be made available to interested parties. It is anticipated that the results of this testing and analysis will demonstrate consistency of results with the previous test procedures. If, in fact, this is the case, this test will be used for all enforcement testing. To insure uniformity in test results, the Agency will provide sleeves to those people requiring them for testing. Only these sleeves will be acceptable for official test-

ing. Calibration procedures for the sleeve will be provided at a later date.

In all of the test procedures, the use of a Flame Ionization Detector (FID) or a Nondispersive Infrared Analyzer (NDIR) is recommended. However, several commenters have suggested that the result obtained from the two instruments are not equivalent. Comments and data are invited on the comparative performance of these two instruments specifically with regard to measuring concentrations of gasoline vapor.

A procedure is presently being developed to assure that the vehicles tested for enforcement purposes are representative of the overall vehicle population. In particular, the procedure will take into account the variation in types of nozzle fits obtained throughout the entire vehicle population. This "sampling plan" is base upon a study conducted under contract by Aerospace Corp., the results of which were published in EPA document number 460/3–75–010. The thirty-nine vehicle-nozzle fit categories in that report have been consolidated into five groups. A total of thirty vehicles would be tested, with a minimum of three from each of those groups. Vehicles with damaged fill necks and those having obstructed access to the fillpipe due to trailer hitches may be excluded from testing. The emissions, in terms of grams per gallon, would be determined for each vehicle, and then averaged for each of the five categories. Then a weighted average of the five categories would be taken, based on the portion of vehicles in the total on-the-road vehicle population which falls in each category. This weighted average would be added to emissions measured at other points in the system and then be compared to the emission standard to determine compliance. The numbers used above are meant to be illustrative of the sampling procedure, and may well be refined in the promulgation of those rules. A report detailing how the fit categories were consolidated, specifying which vehicles fall in each category and listing the population weighting factors will be available from the Director of the Mobile Source Enforcement Division in Washington. The report will also update the vehicle survey conducted by Aerospace Corporation to include newer vehicles.

The use of a sampling plan such as that described above will help assure that emission testing results will be representative of actual systems performance in the field, taking into account the entire vehicle population. However, the substantial number of vehicles required to be tested under any sampling plan prolongs the testing period for each station. Therefore, the Agency is investigating methods of shortening the duration of testing.

One method of achieving this goal involves the use of a "refueling emission simulator tank" (REST). The REST would be a standard gasoline tank with one or more standard fillpipes. The REST would be designed to assure that the emissions measured during the filling of the REST unit closely approximate the mean of measured emissions for the entire vehicle population. Thus, a single refueling of the REST would determine the efficiency of the vapor recovery system to be tested, rather than testing a representative sample of vehicles. The Agency recognizes that achieving a mean vehicle refueling configuration with the REST will present some difficulties. Nevertheless, the advantages of increased simplicity, objectivity, and expeditiousness in testing suggest that the concept should be pursued. Therefore, the Agency solicits comment on both the concept of the REST and specific design specifications for a REST unit. If, by the time of promulgation of these rules, the Agency determines that use of a REST is feasible and design specifications for the unit have been developed, the final rules will incorporate these specifications.

In the October 9, 1975 FEDERAL REGISTER notice, test procedures were proposed for Stage I vapor recovery systems. These tests are being reproposed at this time for prsopective application. Stage I systems which have been installed in conformity with the EPA document "Design Criteria for Stage I Vapor Control Systems at Gasoline Service Stations" are not subject to these tests.

REPORTING REQUIREMENTS

Three reports must be submitted by facility owners. First, each owner must submit certain basic information establishing the category (Class A, B, or C) to which the owner belongs, identifying each facility subject to these regulations and designating the compliance date the facility will meet. This report must be submitted by June 30, 1977, for most facilities now in operation, or by three months prior to the final compliance date for new facilities or facilities whose annual throughput exceeds 120,000 gallons for the first time. This information will permit the agency to determine exactly which facilities must complete installation of a vapor recovery system by a given date.

The second required report must be submitted three months prior to a facility's compliance date and identifies the type of system to be installed at each facility. In addition, some tangible evidence of the decision to install a system must be submitted, such as a purchase order. This report will provide the Agency with an advance assurance that the owner is making progress toward compliance, and will also alert the Agency as to any facility at which owners plan to have a system installed whose performance is suspect on the basis of prior testing experience.

Finally, within 30 days after an applicable compliance deadline, the owner must submit a report of the results of the required start-up test. This report will provide assurance that the system is properly installed and functioning.

Together, the three reports represent the minimum data necessary to keep the Agency apprised of the compliance status of all facilities during the phase-in period. Efforts have been made to reduce the reporting burden as much as possible and to avoid requiring submission of information which might be considered proprietary. In addition reports may be combined for groups or for all of an owner's facilities so that a single report may be submitted covering all facilities. The required reports should not, therefore, represent an onerous burden on facility owners.

The recordkeeping requirements of the October 9 proposal have been deleted, but an owner or operator may choose to keep such records as evidence that he performed required maintenance on the system. If a dispute arises over the responsibility for a malfunction, these records could be used as a defense.

THE INITIAL PERFORMANCE TEST

The proposed rules contain a requirement that the owner of a facility conduct or have conducted an emission test on the installed vapor recovery system. The results of this test must be submitted within 30 days of the applicable compliance deadline. The test must be conducted in accordance with the procedures specified in Appendix F, Part I of the regulations. The Agency views this requirement as essential due to the critical effect of proper installation on system performance. In California, there have been reports of improper installation in up to one-third of all facilities. For example, the underground piping for most systems must slope in the proper direction for the system to operate effectively. A defect such as an improper slope or any other hidden defect will be virtually impossible to detect by visual inspection. Such defects will manifest themselves most clearly in impaired system performance, which can be measured most appropriately by the designated test procedure.

Due to the ongoing demand for testing services created by the phase-in approach, the Agency anticipates that various commercial organizations will offer testing services for a fee. This would obviate the need for each facility owner to purchase test equipment and to hire technicians to run the test. Nevertheless, the need to conduct full scale tests on each facility may be burdensome for some owners. Therefore, the Agency will continue to investigate the practicability of a "quick check" which could give substantial assurance of proper system installation and resulting performance. Comment is solicited on this matter, especially with respect to specific quick checks which could be used.

The Agency will conduct field tests at many facilities and may observe the initial test as well. The Agency will provide its own test equipment for any tests which it conducts. The installation of any auxiliary equipment necessary for performance testing, such as gauges or testing ports which must be incorporated in the vapor recovery system itself, is the responsibility of the owner.

APPLICABILITY OF REGULATIONS

Among the air quality control regions affected by these regulations are por-

tions of two AQCR's in Texas, Dallas-Fort Worth and Houston-Galveston. These two AQCR's were omitted from the October 9 proposal because of the court's decision in *"Texas* v. *EPA"* 499 F. 2d 289 (Fifth Circuit, 1974). In response to the remand in that case, the Agency has prepared a Technical Support Document (No. 906/9–76–001) which discusses the need for hydrocarbon controls in those AQCR's and evaluates various control strategies including Stage II. Similar information is available for other AQCR's in EPA Document No. 450/3–75–046a and in the preambles to the original proposals of Transportation Control Plans.

Facilities within the affected AQCR's can become subject to the proposed rules either by being newly constructed or by exceeding a minimum annual gasoline throughout of 120,000 gallons. In either case, the facility must also come within the applicability of the Stage I vapor recovery regulations to be subject to these regulations.

All new facilities are subject to the regulations regardless of throughput, since the costs of incorporating a vapor recovery system as part of the construction of a new facility are substantially lower than the costs of retrofitting a system at an existing facility. However, only those facilities whose construction is commenced on or after March 31, 1979, the second deadline for submission of a control plan under the phase-in, are deemed "new facilities." This date was selected since by that time all owners, regardless of the classification of their facilities, must have at least begun to make a decision as to which system they will install. Selection of an earlier date might have required premature system selection by owners of Class B or C facilities, since sufficient data might not have been generated by that time from the first portion of the phase-in to provide a basis for their choice of a particular system.

The 120,000 gallons per year throughput requirement is continued from the October 9, 1975, proposal. However, the intermediate category of facilities with an annual throughput between 120,000 and 360,000 gallons, which was contained in the October 9 proposal, has been deleted. This middle group was previously assigned a less stringent emission standard in order to reduce cost differences in terms of cents per gallon for different size facilities. However, several major oil companies have recently reported the development of inexpensive balance and hybrid systems capable of meeting the more stringent standard. In addition, it appears that capital availability is a more significant problem to the smaller organization affected by the regulation than is the cost per gallon. Therefore, all facilities with an annual throughput exceeding 120,000 gallons must meet the same standard.

The October 9, proposal also treated "modified" facilities the same as newly constructed ones, subjecting them to the standards regardless of throughput. An existing facility was deemed modified if the storage capacity of the underground tanks was increased or additional pumps were added. Further analysis led the Agency to reject this approach for three reasons. First, the economies associated with installation of a vapor recovery system as part of the construction of an entire service station are of a greater magnitude than those associated with a modification. For example, under the October proposal if a new pump were added to a facility, the entire facility, not just the new pump, would be required to comply with the standards. Therefore, the existing pumps would have to be retrofitted at higher cost. Second, a new pump could be added, thereby modifying the facility, while the facility's throughput remained at a very low level and the facility remained an insignificant source of hydrocarbon emissions. Third, and conversely, a facility's throughput might substantially increase to a level well above 120,000 gallons per year without the addition of any pumps or the expansion of storage tanks. Under the old definition, such a facility would remain exempt.

The proposed rules resolve these considerations by requiring emission controls at existing facilities solely on the basis of annual throughput during a "representative year." A representative year is any consecutive twelve month period after calendar year 1975, but need not itself be a calendar year. As soon as an existing facility's throughput increases to a level above 120,000 gallons for a consecutive twelve month period, the regulations apply. However, if the owner can adequately demonstrate that the increase is a temporary phenomenon and that the facility's annual throughput will drop below 120,000 gallons in the near future and remain at the lower level, the facility need not comply with the regulations. This approach achieves a more equitable correlation between emission control requirements and the magnitude of an emission source.

Liability for Violations

As a general rule, the owner and the operator of a facility will each be held responsible for any failure of their facility to comply with emission standards after the applicable compliance date. As in the October 9 proposal, the owner is solely responsible for installation of the system in the sense that if a system is not installed by the applicable compliance deadline, the Agency may commence an enforcement proceeding against the owner. This requirement is independent of any contractual arrangements which may exist between various parties regarding who will ultimately pay for the equipment.

The Agency proposes three alternative definitions of the "owner," and requests comments on each. As one alternative, the "owner" could be defined as the person who has equitable title to the gasoline dispensers at a facility. This would change the provision in the October 9 proposal which defined the owner as the person with legal title to the underground tanks and dispensing equipment. It appears that in the vast majority of cases, this change would have no practical effect. However, as suggested in the public comments on the October 9 proposal, in some cases different persons may own the tanks and the dispensers. Therefore, this alternative would narrow the relevant property to the dispensers. In addition, in those rare cases in which the dispensers are held subject to a mortgage, trust, or deed of trust, the real party in interest is the person with equitable title, rather than legal title as in the October 9 proposal. Basing liability on equitable title precludes a situation where, for example, a mortgagee-bank would technically be required to install a vapor recovery system.

One disadvantage of this definition is the possibility that present owners may attempt to divest themselves of dispensers in order to avoid liability for system installation. Service station operators and other individuals should beware of any unsolicited gifts of gasoline dispensing equipment, if this alternative is ultimately adopted.

A second alternative would be to define the "owner" as the person with equitable title to the underground storage tanks. This alternative has most of the same advantages and disadvantages as the previous one.

As a third alternative, the "owner" might be defined as the person with equitable title to the land on which the service station is located, unless the land is subject to a long-term lease, in which case the landowner's lessee would be deemed the "owner". A long-term lease could be defined as one of ten years duration or longer. This approach would be consistent with principles of property law in that the underground piping, and perhaps other portions of the vapor recovery system as well, typically would be considered fixtures under state law and therefore part of the realty. A long-term lessee should be required to install the necessary equipment since the vapor recovery system would be required solely because of his use of the land. In fact, the term of the lease may in some cases exceed the useful life of the system. In that case, neither the landowner nor a subsequent lessee would derive any benefit from the system after the term expired.

The Agency will evaluate comments received on these alternatives and other alternatives and will adopt one definition when these rules are promulgated. The Agency's goal will be to develop a definition which clearly and simply identifies one party as the owner, and which selects a party with a substantial interest in or control over the source of emissions.

Although as a general rule the owner and the operator will each be held liable for violations of the emission standards, where it can be demonstrated that a violation is due to one party's negligence or nonfeasance, the Agency may exercise its enforcement discretion and only seek sanctions against the negligent party. For example, where a violation can be traced to the installation of an inherently

defective vapor recovery system, the Agency would look to the owner to remedy the situation. It must be stressed, however, that both the owner and the operator are responsible for assuring that the emission standards are met on a continuing basis.

Enforcement of the regulations will follow the procedures set out in Title I of the Clean Air Act. When, on the basis of tests or inspections, the Agency concludes that an emission standard has not been complied with, a notice of the violation will be given to the owner and the operator, who will have 30 days after receiving the notice to remedy the violation. If the violation has not been corrected after 30 days, the agency may issue an enforcement order or may bring any other action authorized under section 113 of the Act (e.g., civil or criminal penalties or injunctions). If it is determined that a person has failed to submit in a timely manner any required report, the Agency may inititate a civil action against that person. When similar violations at one facility occur and compliance is only temporary after the notice of violation has been received, the entire period can be treated as a continuous violation. An example of this would be a situation in which a vacuum assist system is installed, but not continuously operated. The system cannot be shut off for 29 days, turned on for two days, then turned off again in an attempt to take advantage of the 30 day notice period in section 113 of the Act. A repeated violation of this nature will be treated as a single continuous violation, and if the pattern continues for more than 30 days, sanctions will be immediately sought, without regard to whether the facility is at that time in compliance.

Future Developments

The Agency will continue to evaluate strategies such as fillneck standardization and on-vehicle controls as long term aids to the refueling emission problem. Standardization of vehicle fillneck configurations may permit the redesign of vapor recovery nozzles to achieve a uniform fit for all cars at the vehicle-fillneck interface, and thereby reduce vapor leakage. It may also be desirable to utilize a positive seal interlock at the interface. Similarly, the use of on-vehicle controls such as collapsible fuel tank liners would essentially prevent vapor formation in the tank. In addition to reducing emissions, the use of these so-called "bladder tanks" might reduce the explosion hazard from rear-end collisions in which the fuel tank is damaged. However, the development of standards by the Agency plus an allowance for adequate lead time to permit vehicle manufacturers to redesign fuel tanks and fillnecks will undoubtedly require several years. Once such measures are initially implemented, a period of at least ten years is required for newer vehicles incorporating these measures to replace older vehicles in the on-the-road vehicle population. Therefore, the Agency will continue to pursue these strategies, while placing primary emphasis on the installation of vapor recovery systems at service stations. The proposed rules represent, in the Agency's opinion, the most expeditious and practicable means of obtaining the emission reductions required by law.

Weights and Measures and Safety Problems

Incidents have been reported in which liquid gasoline has recycled back down vapor return lines, permitting the "overfiling" of the vehicle tanks. Therefore, some state and federal weights and measures authorities have expressed concern that vapor recovery systems may become instruments of consumer fraud. Although recognizing this to be a potential problem, the Agency has no reason to conclude that the problem cannot be solved. Improved shut-off mechanisms and devices limiting minimum gasoline flowrate are capable of preventing overfills. Also, California weights and measures officials have concluded that recycling gasoline through vapor return lines is a relatively rare occurrence which does not present a significant weights and measures problem. While other officials may not agree with that assessment, the problem is solvable with equipment now available from several manufacturers.

Similarly, the issue of the safety of vapor recovery systems has been raised. The use of vapor recovery systems should result in a general improvement in service station safety since vapors which would otherwise mix with the ambient air and become diluted to explosive range concentrations in the area of the filling island will, with the systems, be collected and stored in the underground tank in concentrations above the gasoline's upper explosive limit. The real problem appears to be an administrative one of developing criteria for the assessment of system safety. The California State Fire Marshal's Association is now cooperating with the California Air Resources Board in an effort to accomplish this. It is hoped that the results of their work will be acceptable to fire marshals in other states. There has also been some concern in regard to laboratory listing for safety purposes. Several nozzles and a hybrid system have been listed by one laboratory and at least one vacuum assist system by another. The establishment of safety criteria by the fire marshals should expedite future laboratory testing. The Agency will not require the installation of unsafe equipment, but there is no basis for concluding that safe, approvable systems do not exist or cannot be developed.

Hearings

In order to solicit additional comment and to stimulate local involvement in the development of these regulations, the Agency plans to provide opportunity for a series of public hearings. These hearings will be legislative-type hearings having no adversary parties as such, and no cross-examination of witnesses. However, clarifying questions may be asked and participants may submit, in advance to the hearing panel, written questions to be directed to other participants. Technical rules of evidence will not apply. Persons desiring to make presentations at the hearings should provide a written copy of their statement to the Agency one week in advance of the hearing. In order to assure full opportunity for the presentation of data, views, and arguments, additional written submissions will be accepted for 20 days after each hearing. The Agency will set no limit on the amount of written material which may be submitted, but participants may be required to limit oral presentations due to the number of participants.

A verbatim record of each hearing will be made and a copy of the transcript will be made available on request at the expense of the person so requesting. Copies of the transcripts and of all written submissions for the hearing record will be available for public inspection at the EPA Public Information Reference Unit, 401 M St. SW., Washington, D.C. and at the EPA Regional Offices for those Regions in which a hearing is held. Copies of public comments will also be available for inspection at the EPA Public Information Reference Unit.

One hearing will be held beginning at 9:00 a.m. on January 5, 1977, at the General Services Administration auditorium, 18th and F Streets, NW, Washington, D.C. This hearing is provided for those potentially affected by the promulgation of vapor recovery regulations for the National Capital AQCR. In addition, the Agency requests that all national organizations such as equipment vendors and major oil companies which are affected by the regulation in more than one region and which desire to express their views attend the "national" hearing in Washington. This will avoid repeating the same information at more than one hearing and will provide highly useful discussion at the hearing.

Benjamin R. Jackson, Director of the Mobile Source Enforcement Division of EPA, has been designated the Presiding Officer for the hearing. He will have the responsibility for maintaining order, excluding irrelevant or repetitious material, scheduling presentations, and, to the extent possible, notifying participants of the time at which they may appear. Persons and organizations desiring to participate in this hearing should file a notice of such intention, along with a description of their proposed statement, by December 15, 1976, with the Director, Mobile Source Enforcement Division (EN-340), U.S. Environmental Protection Agency, Room 3220, 401 M St., SW, Washington, D.C. 20460.

Hearings will also be held, to the extent there is an expressed interest, in each state in which the rules will apply. Persons desiring such a local hearing should send a request to the appropriate EPA Regional Administrator by December 15, 1976. If only limited interest is expressed in a hearing in a particular state, the Agency may suggest that the hearing be consolidated with another hearing. The Agency will then publish a notice in the Federal Register specifying the time and location for the local hearings which are requested.

The following is a list of regional office addresses:

U.S. EPA, Region I, John F. Kennedy Federal Building, Room 2203, Boston, Massachusetts 02203.
U.S. EPA, Region II, 26 Federal Plaza, Room 1009, New York, New York 10007.
U.S. EPA, Region III, Curtis Building, 6th & Walnut Streets, Philadelphia, Pennsylvania 19106.
U.S. EPA, Region VI, 1201 Elm Street, First International Building, Dallas, Texas 75270.
U.S. EPA, Region VIII, 1860 Lincoln Street, Denver, Colorado 80203.
U.S. EPA, Region IX, 100 California Street, San Francisco, California 94111.

The information adduced at the hearings will become part of the basis upon which final regulations will be promulgated. In addition, information contained in the public comments and other scientific, engineering, and related pertinent information not included in the transcript of the public hearing may be considered in promulgating the final rules.

Environmental and Inflationary Impact Statement Requirements

The Agency is under no statutory duty to prepare an environmental impact statement to accompany these regulations. 15 U.S.C. 793(c)(1). The Agency has prepared guidelines indicating for which regulatory actions it will voluntarily prepare an EIS. 39 FR 37419. These amendments to the Stage II vapor recovery regulations fall within none of the categories of applicability in section 1(c) of the guidelines. Therefore, the voluntary EIS guidelines are inapplicable.

The Inflationary Impact Statement requirements of Executive Order 11821 and OMB Circular A-107 are also inapplicable. The proposed amendments have a very limited impact on the existing vapor recovery regulations; they specify test procedures, enforcement procedures, and reporting requirements and exempt facilities whose through-put is less than 120,000 gallons per year. Thus, the net economic impact of these amendments is undoubtedly a reduction in costs, and therefore no inflationary impact statement is required. Even when viewing the entire vapor recovery program as a whole, its total cost does not exceed the I.I.S. guideline.

Public Comments

Comments on these proposed amendments should be submitted, preferably in triplicate, to Mr. Roger Strelow, Office of Air and Waste Management (AW-443), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460. All comments postmarked no later than on or before January 31, 1977, will be considered. Comments previously submitted on the October 9 proposal will be deemed incorporated by reference into the docket for this reproposal. Therefore, the Agency requests that comments submitted on this reproposal not be repetitive of information previously submitted. All comments submitted and other parts of the record will be available for public inspection during normal business hours in the EPA Public Information Reference Unit in Washington.

(Secs. 110, 113, 114, 801(a), Clean Air Act as amended (42 U.S.C. 1857c-5, 1857c-8, 1857c-9, 1857g(a)).)

Dated: October 21, 1976.

John Quarles,
Acting Administrator.

References

1. Stage II Vapor Recovery Short Test Procedure, Office of Enforcement, EPA, August, 1976.
2. Vincent, Edwin J., Uncontrolled Gasoline Vapor Emission Rates from Refueling of Vehicles, Emission Standards and Engineering Division, EPA, August 1976.
3. Lee, Warner B., Evaluation of Interface Between Vehicle Fuel Filipipes and Vapor Recovery Nozzles, Prepared for EPA by the Aerospace Corporation, Contract Number 68-01-0417, October 1975.
4. Stage II Hydrocarbon Vapor Control with the Texaco Balance System, Texaco, Inc., May 12, 1976.
5. Hochhauser, A. M., and Bernstein, L. A., A Service Station Test of a Vapor Balance System for the Control of Vehicle Refueling Emissions, Exxon Research and Engineering Company, July 1, 1976.

It is hereby proposed that Part 52 of Title 40, Chapter I, of the Code of Federal Regulations be amended as follows:

§§ 52.1102 and 52.2289 [Removed]

1. §§ 52.1102 and 52.2289 to be deleted.
2. Each of the following sections listed below is to be revised:

A. Subpart F-§ 52.256 Control of evaporative losses from the filling of vehicular tanks. (Metropolitan Los Angeles, Sacramento Valley and San Joaquin Valley Intrastate Air Quality Control Regions),

B. Subpart G-§ 52.337 Control of evaporative losses from the filling of vehicular tanks. (Metropolitan Denver Intrastate Air Quality Control Region),

C. Subpart J-§ 52.488 Control of evaporative losses from the filling of vehicular tanks. (District of Columbia portion of the National Capital Interstate Air Quality Control Region),

D. Subpart V-§ 52.1087 Control of evaporative losses from the filling of vehicular tanks. (Maryland portion of the National Capital Interstate Air Quality Control Region and the Metropolitan Baltimore Interstate Air Quality Control Region),

E. Subpart W-§ 52.1144 Control of evaporative emissions from retail gasoline outlets. (Metropolitan Boston Intrastate Air Quality Control Region),

F. Subpart FF-§ 52.1599 Control of evaporative losses from the filling of vehicular tanks. (New Jersey portion of the New Jersey-New York-Connecticut and Metropolitan Philadelphia Air Quality Control Regions),

G. Subpart SS-§ 52.2288 Control of evaporative losses from the filling of vehicular tanks. (Portion of Dallas-Fort Worth Intrastate Air Quality Control Region located in Collin, Dallas, Denton, Ellis, Hood, Johnson, Kaufman, Parker, Rockwall, Tarrant and Wise Counties and portion of Houston-Galveston Intrastate Air Quality Control Region located in Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, and Waller counties), and

H. Subpart VV-§ 52.2438 Control of evaporative losses from the filling of vehicular tanks. (Virginia portion of the National Capital Interstate Air Quality Control Region).

§ 52.____ Stage II gasoline vapor recovery.

(a) *Applicability*—(1) The provisions of this section are applicable to each owner or operator, as defined in paragraph (b) of this section, whose facility is located within the _____ Air Quality Control Region if (i) such facility dispenses 120,000 gallons or more of gasoline during any representative year, or (ii) the construction of such facility was commenced on or after March 31, 1979. This section is also applicable to each person who supplies gasoline to such a facility.

(b) *Definitions.* (1) "Administrator" means the Administrator of the Environmental Protection Agency, a Regional Administrator or the representative of either.

(2) "Commence construction" of a facility means to initiate a continuous program of on-site contruction, including related site clearance, grading, dredging, or land filling.

(3) "Facility" means any site where gasoline is dispensed to motor vehicle fuel tanks from stationary storage tanks and which is subject to the gasoline transfer vapor control requirements of § _____. A facility will be designated a "Class A facility" if the owner is a Large Integrated Refiner; a "Class B facility" if the facility sells gasoline at retail but is not a Class A facility; and a "Class C facility" if the facility is neither a Class A nor a Class B facility.

(4) "Gasoline" means any petroleum distillate having a Reid Vapor Pressure of four pounds or greater.

(5) "Large Integrated Refiner" means a refiner which obtained directly or indirectly, in the third quarter of 1973, less than 70 percent of its refinery input of domestic crude oil (or 70 percent of its refinery input of domestic and imported crude oil) from producers who do not control, are not controlled by, and are not under common control with such refiner. (Reference: "Petroleum Market Shares—Historical Report on Refiners and Importers of Motor Gasoline, 1972 through 1974," Federal Energy Administration, FEA/S-75/616).

(6) "Operator" means any person or business entity which operates, supervises, or is the lessee of a facility.

(7) "Owner" means (see alternatives in Preamble).

(8) "Representative year" means any consecutive twelve month period commencing on or after January 1, 1975, unless gasoline throughput for that period can be shown by the owner to be unrepresentative of future throughput.

(9) "Spillage" means any quantity of liquid gasoline that leaks or spills from the fillneck or any part of the nozzle at any stage of the vehicle refueling process. Spilled gasoline may collect in the sheet metal or rubber pieces around the fillneck or on the nozzle itself, wash down the side of the vehicle or fall to the ground. Spillage includes the phenomenon of spitback.

(10) "Spitback" means the leakage, discharge or spillage of liquid gasoline from the fillneck occurring when the

nozzle shut-off mechanism does not operate rapidly enough to prevent overfilling, or when a bubble of vapor trapped in the vehicle fuel tank sprays gasoline out of the fillneck when the nozzle seal is broken.

(11) "Stage II" means the vehicle refueling operation and the vapor recovery system at a gasoline dispensing facility.

(12) "System" means any Stage II vapor recovery system including all of the parts, components, guages, and associated equipment necessary to ensure that a facility controls gasoline vapor losses to the degree required by this regulation.

(13) "Vehicle" means any light-duty vehicle or light-duty truck as defined in 40 CFR 86.077–2.

(c) *Standards.* (1) No owner or operator shall cause or allow the transfer of gasoline to a vehicle fuel tank from a facility unless the transfer is made through a system which:

(i) Limits the discharge of hydrocarbons into the atmosphere as a result of the refueling operation to (see Preamble) gram of hydrocarbon vapor per gallon of fuel dispensed, as determined by the testing methods and procedures in Appendix F of this Part.

(ii) Limits the occurence of vehicle fuel tank overfills or spillage to no more than 15 of each 100 vehicle fillings.

(2) After the applicable date specified in paragraph (e) of this section no person shall supply gasoline to any facility at which a Stage II vapor recovery system is required but has not been installed.

(d) *Reporting requirements.* (1) Each owner shall submit by June 30, 1977, or, for facilities subject to paragraph (e)(1)(v), (vi), or (vii), by three months prior to their applicable compliance date, the following information:

(i) The owner's name (state entire corporate name if a corporation);

(ii) The owner's mailing address;

(iii) The name, address, and telephone number of the person to whom questions relating to the reports required by this paragraph should be directed;

(iv) A stipulation as to which of the classes in paragraph (b)(3) of this section the owner belongs;

(v) The address and applicable compliance date, as specified in paragraph (e)(1) of this section, for each facility subject to this regulation and of which he is the owner.

(2) Every owner shall submit to the Administrator no later than three months prior to each facility's applicable compliance date specified in paragraph (e)(1) of this section, a control plan for such facility. Such plan shall include:

(i) The owner's name and the address of each facility covered by the control plan;

(ii) A description of the system to be installed, including its make and model, and a copy of a purchase order, contract, or other similar document demonstrating a commitment to install the system.

(3) Within thirty days after the applicable compliance date specified in paragraph (e)(1), the owner shall submit a report of the results of the performance test conducted pursuant to paragraph (f) of this section for each facility.

(4) Any of the reports required by this paragraph (d) of this section may be combined into a single report to cover groups of an owner's facilities, provided that the combined report contains all required information for each facility and is submitted in a timely manner.

(5) All reports submitted pursuant to this paragraph shall be addressed to the Director, Mobile Source Enforcement Division (EN–340), U.S. Environmental Protection Agency, 401 M St., SW., Washington, D.C. 20460. An additional copy of these reports shall be sent to the EPA Regional Office for the region in which the facility is located, to the attention of the Director, Enforcement Division, at the address specified in 40 CFR 52.16.

(e) *Compliance deadlines.* (1) The owner shall complete installation of a system by, and the owner and the operator shall assure operation of the system so as to comply with the requirements of paragraph (c) at all times after, the dates specified below:

(i) December 31, 1977, for twenty percent of the Class A facilities;

(ii) June 30, 1979, for (A) the remaining eighty percent of Class A facilities, (B) the one-third of the Class B facilities with the greatest throughput, and (C) all Class C facilities;

(iii) June 30, 1980, for the one-third of Class B facilities with the next greatest throughput;

(iv) June 30, 1981, for the remaining one-third of Class B facilities;

(v) By the applicable date specified in paragraph (e)(1)(i) through (e)(1)(iv) of this section or six months after such increase, whichever is later, for facilities which become subject to these regulations after June 30, 1977, due to increases in throughput during a representative year to a level above that specified in paragraph (a)(1)(A) of this section;

(vi) By the time of initial operation for facilities whose construction is commenced after March 31, 1979;

(vii) By the applicable date in paragraphs (e)(1)(i) through (e)(1)(iv) of this section or by the time of initial operation, whichever is later, for facilities whose construction is commenced between January 1, 1977, and March 31, 1979, and which can reasonably be expected to achieve or exceed the throughput specified in paragraph (a)(1)(A) of this section. If an owner fails to install a system by such time on the basis of a good faith prediction that gasoline throughput will not meet or exceed the criterion in paragraph (a)(1)(A) of this section, and such criterion is subsequently exceeded, compliance shall be achieved as in paragraph (e)(1)(v) of this section.

(2) In calculating the number of stations for which system installation is required in a given year, fractions shall be rounded so that the extra facilities complete installation in the earliest applicable phase-in year.

(f) *Performance tests.* (1) Within 30 days after the applicable compliance deadline in paragraph (e) of this section the owner shall conduct or cause to have conducted a performance test on each system installed pursuant to paragraph (e) of this section. Such test shall be performed in accordance with procedures specified in Appendix F, Part I. Test results shall be reported according to paragraph (d)(3) of this section. The Administrator may also require testing at such other times as he may designate in accordance with section 114 of the Clean Air Act.

(2) The owner shall, upon receipt of notice from the Administrator prior to the compliance deadline in paragraph (e)(1) of this section, provide the Administrator seven days notice of the time of commencement of testing pursuant to this paragraph. The Administrator may send representatives to observe such testing.

(3) Authorized agency officials may conduct any testing pursuant to this paragraph (f) of this section, in accordance with section 114 of the Clean Air Act. The owner shall provide or cause to be provided gauges, testing ports, and other facilities necessary to the conduct of the tests specified in Appendix F of this Part.

3. It is proposed to amend Part 52 of Title 40 of the Code of Federal Regulations by adding Appendix F as follows:

APPENDIX F—FIELD TEST PROCEDURES FOR STAGE II CONTROL SYSTEMS

I. Short test procedure.
- 1. Principle.
- 2. Applicability.
- 3. Definitions.
- 4. Summary of Method.
- 5. Test Scope and Conditions Applicable to Test.
- 6. Basic Measurements and Equipment Required.
- 7. Test Procedure.
- 8. Calculations.
- 9. Calibration.

II. Combination baseline/leakrate test.
- 1. Principle.
- 2. Applicability.
- 3. Definitions.
- 4. Summary of the Methods.
  - 4.1 Stage I Operations at Vapor Balance Systems.
  - 4.2 Stage II Operations at Vapor Balance Systems.
  - 4.3 Stage I Operations at Vacuum Assisted Vapor Recovery Systems.
  - 4.4 Stage II Operations at Vacuum Assisted Vapor Recovery Systems.
- 5. Test Scope and Conditions Applicable to Stage II Testing.
- 6. Basic Measurements and Equipment Required.
  - 6.1 Stage I Operations at Vapor Balance Systems.
  - 6.2 Stage II Operations at Vapor Balance Systems.
  - 6.3 Stage I Operations at Vacuum Assisted Systems.
  - 6.4 Stage II Operations at Vacuum Assisted Systems.
- 7. Test Procedures.
  - 7.1 Stage I Operations at Vapor Balance Systems.
  - 7.2 Stage II Operations at Vapor Balance Systems.

7.3 Stage I Operations at Vacuum Assisted Systems.
7.4 Stage II Operations at Vacuum Assisted Systems.
8. Calculations.
8.1 Stage I Operations at Vapor Balance Systems.
8.2 Stage II Operations at Vapor Balance Systems.
8.3 Stage I Operations at Vacuum Assisted Systems.
8.4 Stage II Operations at Vacuum Assisted Systems.
9. Calibrations and Specifications.

I. SHORT TEST PROCEDURE

1. *Principle.* Hydrocarbon mass emissions are determined directly using flow meters and hydrocarbon analyzers. The volume of gasoline dispensed is determined. Results are expressed in terms of grams emitted per gallon dispensed.

2. *Applicability.* This method is applicable to determining emission rates during normal operation of vehicle refueling at gasoline dispensing facilities.

3. *Definitions*—3.1 *Stage II.* Vehicle refueling operations.

4. *Summary of Method.* This procedure is performed by direct measurement of vapor emissions during normal operation of the service station. Hydrocarbon mass emissions are collected at the vehicle, at vents to underground tanks and, when there is a secondary processing unit, at the exhaust. The measured losses at each point are combined and reported as the mass of hydrocarbons emitted per unit volume of gasoline dispensed.

5. *Test Scope and Conditions Applicable to Test*—5.1 *Number of vehicles to be tested.* Thirty vehicles shall be tested, with a minimum of three tested from each of the categories described in "Vehicle Fillneck Categories for Stage II Testing," which will be available from the Mobile Source Enforcement Division (EN–340), Environmental Protection Agency, 401 M Street, SW., Washington, D.C. 20460.

5.2 *Station status during test period.* The test procedure is designed to measure control efficiency under conditions that are routine at the station being tested.

5.2.1. *Closing of pumps.* Product lines not interconnected to or sharing control equipment with the product lines being tested may be closed.

5.2.2. *Acceptance of vehicles.* Vehicles shall, to the extent possible, be tested consecutively in the order in which they arrive for fueling at the dispensers at which testing will occur. Vehicle testing shall continue until a total of thirty vehicles have been tested, with at least three vehicles falling within each vehicle-fit category. Vehicles from a given category may be omitted from testing when the only vehicles necessary to complete the sample of thirty fall in other vehicle categories.

5.2.3 *Dispensing rates shall be set at the maximum rate at which the equipment is designed to operate.* This fill rate shall be used unless fillneck configuration requires filling at a lesser rate.

5.2.4 If a facility employs both the attendant service and self-service modes of operation, testing shall be conducted at the self-service island. When testing at self-service islands, fueling shall be performed by the gasoline purchaser without any assistance or special instructions from facility attendants beyond that which is usually given. When testing at attendant-served facilities, and where the nozzle will latch in the vehicle fillneck or remain there without being held by the attendant, filling shall be accomplished "hands off." When this is not possible, the attendant shall hold the nozzle in the normal manner, without making any special efforts to achieve a tight fit beyond that which is done regularly when system testing is not taking place.

5.2.5 Vehicles may be omitted from testing if they fall within none of the categories, or if the vehicle fillneck is damaged or has a trailer hitch or other similar obstruction which inhibits access to the fillnecks, or if the test sleeve interferes with the vehicle-nozzle fit.

5.3 *Ambient temperatures.* Tests of vehicle refueling emissions will be made at any ambient temperature.

5.4 *Dispensed fuel RVP.* The RVP of the fuel dispensed during the test shall be within the range which is normal for the geographic location and time of year of the test.

6. *Basic measurements and equipment required*—

6.1 Basic measurements required are described below.

Sample	*Measurement necessary*
Dispensing nozzle-vehicle fillneck interface.	Hydrocarbon concentration of vapor collected by test sleeve. Volume of vapor collected by test sleeve. Temperature of vapor collected by test sleeve.
Vent outlet of underground tank and processing unit.	See Preamble.
Ambient	Atmospheric pressure. Ambient temperature.
Gas pump	Volume of gasoline dispensed during test period. Volume of gasoline dispensed for each vehicle used during test.
Underground tank	Sample for Reid vapor pressure analysis. Sample for tank volume.

6.2 The equipment required for the basic measurements are listed below. Alternative equipment may be used subject to the approval of the Administrator.

Measurement	*Equipment specifications*
Volume of vapor collected by test sleeve.	Gas meter (dry, wet, or positive displacement) capable of measuring at a rate of 5 cfm with an accuracy not less than ±1%.
HC concentration of vapor collected by test sleeve.	Appropriate test sleeves supplied by EPA. Total hydrocarbon analyzer and recorder equipped to read 0–100% HC as propane (Flame Ionization Detector or Non-Dispensive Infrared Analyzer are recommended). Response 90% in one second.
Pressure of vapor collected by test sleeve.	Gauge or manometer with range of 0–5" Hg vacuum and accurate to ±0.5" Hg.
Underground tank volume.	Rod to measure liquid depth to ±1".
Sample for RVP analysis	Gasoline sample thief (ASTM 0–R70).
Atmospheric pressure	Mercury barometer or local weather station readings.
Ambient temperature	Aspirated thermometer (0–150°) accurate to ±1° F.
Temperature of collected vapors.	Thermometer or thermocouple (0–150° F) accurate to ±1° F.

7. *Test Procedure*—7.1 Preparation for testing at nozzle fillneck interface, at vents, and at exhausts.

7.1.1 Connect collection sleeve to gas meter inlet with minimum 0.5" nylon or neoprene tubing.

7.1.2 Attach pressure gauge or manometer and thermometer to gas meter.

7.1.3 Connect vacuum side of explosion proof pump to gas meter exit with minimum 0.5" nylon or neoprene tubing.

7.1.4 Connect control valve and muffler to pump exhaust. The control valve should be set so that the flow rate through the meter is between 3.2 and 3.5 cubic feet per minute.

7.1.5 Install analyzer tap and analyzer on pump exhaust line.

7.1.6 Span and calibrate analyzers and meters according to Section 9.

7.1.7 Insert nozzle into test sleeve and dispense gasoline in normal manner.

7.2 *At dispenser pumps.* Measure initial and final volume readings for all pumps during each test period.

7.3 *At underground tank.* Record initial and final underground tank volumes for each test period. Collect sample (by ASTM–270 part 27 procedure) for RVP analyses (according to ASTM–323) at the beginning of each test day.

7.4 *Ambient measurements.* At the beginning of each test period and hourly during testing determine ambient temperature and pressure.

7.5 Measurements and data required for each vehicle used in the test.

7.5.1 Record license numbers, make, model, year and fill neck location.

7.5.2 Record gas meter reading at beginning of test.

7.5.3 Mark beginning of test on HC recorder.

7.5.4 Record vapor temperature and pressure during test.

7.5.5 Mark end of test on HC recorder.

7.5.6 Record gas meter reading at end of test.

7.5.7 Record gasoline volume dispensed during test.

7.5.8 Record any incidents of spitback or spillage.

7.6 Measurements and data required at vents and exhausts.

7.6.1 Record gas meter reading at beginning of test.

7.6.2 Mark beginning of test on HC recorder.

7.6.3 Record vapor temperature and pressure hourly.

7.6.4 Record end of test on HC recorder.

7.6.5 Record gas meter reading at end of test.

8. *Calculations*—8.1 *Terminology.*

C_e—Average concentration of exhausted hydrocarbons from each vehicle at dispenser (% HC/100 as propane).

C_v—Average concentration of exhausted hydrocarbons at vent or control device (% HC/100 as propane).

K_i—Sales weighting factors for vehicle fit category i.

L_s—Volume of gasoline dispersed for test vehicles (gal).

L_v—Volume of gasoline dispensed at station during entire test period (gal).

M_d—Mass of hydrocarbon vapor collected at the fillneck during a single vehicle test (g).

M_v—Mass of hydrocarbon vapor collected from vent or control device during entire test period (g).

$(m/L)_d$—Mass emission rate at dispenser (g/gal).

$(m/L)_{di}$—Mass emission rate at dispenser for vehicle fit category 1 (g/gal).

$(m/L)_T$—Total mass emission rate of system (g/gal).

$(m/L)_v$—Mass emission rate at vent or control device (g/gal).

P—Atmospheric pressure (in. Hg).

P—Gauge pressure on dry gas meter at dispenser (in. Hg vac.).

P—Gauge pressure on dry gas meter at vent or control device (in. Hg vac.).

T—Ambient temperature (F).

T—Temperature of vapor at dry gas meter on dispenser (F).

T—Temperature of vapor at dry gas meter on vent or control device (F).

V—Final volume reading of gas meter at dispenser (ft).

V—Final volume reading of gas meter at vent or control device (ft).

V—Initial volume reading of gas meter at dispenser (ft).

V—Initial volume reading of gas meter or control device (ft).

V—Volume of vapors collected from each vehicle at standard condition (ft).

V—Volume of vapors collected from each vent or control device at standard conditions (ft).

8.2 Standard volume of vapor collected from each vehicle.

$$V=(V-V)\ (P-P)\ 530\ 29.92\ T+460$$

8.3 Mass emission from individual vehicles.

$$M_d=51.7\ C_dV_{id}$$

8.4 Mass emission rate at dispenser, for vehicle fit category i, i=1 . . . 6.

$$(m/L)_{di}=\frac{\sum_i M_d}{\sum_i Ld}$$

8.5 Mass emission rate at dispenser.

$$(m/L)_d=\sum_{i=1} Ki(m/L)$$

8.6 Standard volume of vapor collected from vent or control device.

$$V_{sv}=(V_{fv}-V_{iv})\cdot\frac{(P_{atm}-P_{sv})}{29.92}\cdot\frac{530}{(T_{sv}+460)}$$

8.7 Mass emission from vent or control device.

$$M_v=51.7(C_vV_{sv})$$

8.8 Mass emission rate at vent or control device.

$$(m/L)_v=\frac{M_v}{L_v}$$

8.9 Mass emission rate of station.

$$(m/L)_T=(m/L)_d+(m/L)_v$$

8.10 Determine the total number of vehicle fillings during which spillage or spitback was recorded. Report this as the number per 100 fillings.

9. *Calibration*—to be provided at a later date.

II. Combination Baseline/Leakrate Test

1. *Principal.* Hydrocarbon mass emissions are determined directly and indirectly using flow meters and hydrocarbon analyzers. The volume of liquid gasoline dispensed (or transferred to the underground tank) is determined. Results are expressed in terms of grams emitted per gallon dispensed (or control efficiency for underground tank fillings).

2. *Applicability.* This method is applicable to determining emission rates and spillage frequency during normal operation of gasoline service stations employing vapor balance or vacuum assist type of control systems. The method is applicable to both vehicle refueling and underground tank filling operations at service stations employing either type of control systems. The spitback test may be performed simultaneously with or independent of emission tests.

3. *Definitions*—3.1 *Potential emissions.* As used in this method, the term "potential emissions" means the vapor emissions which would be returned to the underground tank during stage II refueling operations employing vapor balance equipment, when no vapor escapes to the atmosphere from the vehicle tank or the nozzle/fillneck interface.

3.2 *Vapor balance or displacement vapor recovery system.* A gasoline vapor control system which prevents the emission of vapors into the atmosphere during Stage I and/or Stage II operations by displacing vapors into the underground tank (Stage II) or tank truck (Stage I), but which does not require secondary treatment or processing of the vapor mixture. For the purposes of testing, the so-called hybrid systems which include vacuum or flow inducing devices but which do not induce sufficient flow to require processing equipment, are considered to be vapor balance systems.

3.3 *Vacuum assisted or secondary system.* A gasoline vapor control system which employs a pump, blower, or other vacuum inducing device to collect and/or which employs carbon, flame or catalytic combustion, refrigeration, and/or compression type secondary systems to process vapors generated during stage I and/or stage II operations.

3.4 *Stage I.* Underground tank refilling operations.

3.5 *Stage II.* Vehicle refueling operations.

3.6 *Automatic Nozzle.* A nozzle which is capable of dispensing fuel without being hand held.

4. *Summary of the Methods.* This procedure describes test conditions and test procedures to be followed in determining hydrocarbon emission rates from vapor balance and vacuum assisted systems installed to control emissions resulting from vehicle refueling operations and from underground tank refilling operations. Four procedures are included applicable to the four respectively noted systems and operations. A summary of each procedure is provided in the following paragraphs.

4.1 *Stage I operations at vapor balance systems.* Direct measurements of vent losses are made for determination of emission losses and system efficiency of vapor balance collection systems during bulk deliveries to gasoline service stations. The volume of vapors exhausted to the atmosphere during a bulk delivery are measured. Control efficiency is determined from the ratio of volume emitted (corrected to the temperature of the underground tank) divided by the volume of gasoline delivered.

4.2 *Stage II operations at vapor balance control systems.* This procedure is performed during normal operation of the service station. With the test method, gasoline vapor volume losses at the vehicle are determined indirectly by establishing a vapor leak rate versus fillneck pressure curve and monitoring the fillneck pressure during the dispensing of gasoline. Hydrocarbon concentration is measured in the vapor return hose. The mass emission is calculated using the determined volume losses and the measured concentration. The vapor volume returned to the control system is also measured with a low back pressure dry gas meter and a baseline curve of potential emissions is established with data from vehicle refueling during which no vapor losses occurred. The baseline data are used in lieu of leaked vapor loss determinations for vehicles with large volume leaks and for comparison checks. Losses at the vent from the underground supply tank are measured and included in the total gasoline vapor loss determination. Results are expressed as mass of hydrocarbons emitted (as propane) per unit volume of fuel dispensed. This approach is applicable to any vapor control system utilizing tight-fitting dispensing nozzles even though vapor return flow may be induced by mechanical means.

4.3 *Stage I operations at vacuum assisted systems.* Direct measurements of volume and hydrocarbon concentration of exhaust gases are made in order to determine efficiency of the secondary system to control vapors lost during bulk gasoline deliveries. All possible points of emissions are checked for vapor leaks and estimates or direct measurements of leaks are made and are included in the emission calculations.

4.4 *Stage II operations at vacuum assisted systems.* Emissions are determined by direct measurement during normal operation of the service station. Hydrocarbon mass emitted from the exhaust of the secondary control device is measured. All points of possible emissions are checked for vapor leaks and estimates or direct measurements of leaks are made. These vapor losses are added to the emissions from the secondary control device and are included in calculating total emission. Results are expressed in terms of mass of hydrocarbons emitted per unit volume of gasoline dispensed from the system. The method includes a mass balance procedure to verify that any leaks are taken into account. A mass balance calculation showing unaccounted vapor losses voids the emission test.

5. *Test scope and conditions applicable to Stage II Testing.*—5.1 *Test Period.* The elapsed time during which the test is performed shall not be less than three days.

5.2 *Number of vehicles to be tested.* The number of vehicles used during a test shall be not less than 100 and of these, at least 20 shall meet the criteria set for baseline vehicles.

5.3 *Station status during test period.* The test procedure is designed to measure control efficiency under conditions of normal operation. Normal operation will vary from station to station and from day to day. Therefore, no specific criteria are set forth to define normal. The following guidelines are provided to assist in determining normal operation.

5.3.1 *Closing of pumps.* During the test period, at least two pumps shall be open and utilized on each product line which is controlled by the device or is interconnected into the system under test. If product lines involve no interconnection of liquid or vapor lines and do not share control equipment, the product line not being tested may be closed.

5.3.2 *Acceptance of vehicles.* During the test period, no vehicle arriving for the purpose of refueling from the product under test shall be turned away. No other measures shall be employed which would limit the

number or types of vehicles which would normally be served on a daily basis, from the product line under test.

5.3.3 Simultaneous use of more than one pump shall occur to the extent that such use would normally occur.

5.3.4 Dispensing equipment shall be set to dispense at the maximum rate at which the equipment is designed to be operated. This rate shall be determined during each test. During refueling, all nozzles shall be latched at a setting designed to dispense at this maximum rate. (Due to simultaneous use of pumps, the actual dispensing rate may vary even though the nozzle is set for the maximum rate.) Where fillneck configuration prevents filling at maximum rate, fill rates may be limited as follows: When premature shut-off occurs, a second attempt shall be made to dispense gasoline at the highest rate. If premature shut-off occurs a second time, then dispensing shall be attempted at the next lower nozzle setting. If premature shut-off occurs twice at this setting then the lowest rate nozzle setting shall be attempted. If premature shut-off occurs twice at this setting then hand holding may be used. In the latter event, the vehicle will not be included in the calculations.

5.3.5 All fillings, both at test dispensers and at dispensers vehicle are interconnected into the control system, but which are not being tested shall be accomplished "hands off." Only such "hands off" fillings shall be considered valid for the purposes of this method. Where this is not possible, hand held operation is acceptable. Included in such situations is the case where the dispensing nozzle would fall out of the vehicle fillneck if not hand held in place. Such "hand held" fillings shall not be included in the calculations under this method. The requirements of this paragraph will preclude customer or self service fillings during the test period.

5.4 *Distribution of vehicles by make and model.* The distribution of vehicles refueled during the test period at any single station shall be reasonably representative of the U.S. on the road vehicle distribution.

In order to conform to such distribution, as necessary, proration of the vehicles tested in each class may be made. The purpose of such proration would be to bring the tested distribution into conformance with the actual U.S. vehicle distribution.

5.5 *Simultaneous Stage I and Stage II operations.* Stage II test results should be obtained without influence from simultaneous Stage I operations.

6. *Basic Measurements and equipment required.*—6.1 *Stage I.* Operations at vapor balance systems.

6.1.1 *Basic measurements required.* The sampling points are numbered and shown in Figure 1. Some measurements are noted as optional. These are not necessary in the determination of emission rate, but can assist in evaluating the performance of the vapor recovery system.

System Point	*Measurements Necessary*
1 (vent outlet for underground tank).	Volume of vapors exhausted.
2 (underground tank).	Temperature of liquid; volume of liquid.
3 (bulk delivery tank).	Temperature of liquid (optional); pressure in tank (optional); check for hydrocarbon leaks at all connections.

6.1.2 The equipment required for the basic measurements are listed below. Alternative equipment may be used subject to the approval by the Administrator.

Sample point	*Equipment and specifications*
1	1 gas volume meter (3 cfm).
2	1 flexible thermocouple with readout (range 0–150° F).
3	1 flexible thermocouple with readout (range 0–150° F). 1 0–10" H_2O manometer. 1 portable combustible gas detector (at least 0–100% lower explosive limit range).

6.2 *Stage II operations at vapor balance systems.*

6.2.1 *Basic measurements required are described below.* Some measurements are noted as optional. These are not necessary in the determination of emission rate, but can be of value in the description and explanation of the operation of the vapor recovery system. Referring to Figure 1, the various sampling points in the system are numbered.

Sample point	*Measurements necessary*
4 (dispensing nozzle and vehicle fillneck).	Check for gasoline vapor leaks around nozzle-fillneck interface during refueling; temperature of vehicle tank prior to refueling; hydrocarbon concentration of returned vapors; temperature of returned vapors during refueling (optional); temperature of dispensed gasoline during refueling; static pressure at nozzle fillneck interface during refueling and leak check.
5 (vapor return line).	Volume of gasoline vapors returned during refueling; volume of leak during leak check static pressure (optional).
6 (gasoline meter and pump).	Volume of gasoline dispensed for each vehicle; volume of gasoline dispensed during test period.
1 (vent outlet for underground tank).	Volume of vapors exhausted via solenoid valve device (Figure 3); hydrocarbon concentration of exhausted vapors.
2 (underground tank).	Temperature of liquid in underground tank (optional); volume of liquid; sample for Reid vapor pressure analysis.

6.2.2 *The equipment required for the basic measurements are listed below.* Alternative equipment may be used subject to approval of the Administrator.

Sample point	*Equipment and specifications*
4[1]	1 portable combustible gas detector (at least 0–100% of lower explosive limit range); 3 flexible thermocouples (range 0–150° F) and recorders; 1 total hydrocarbon analyzer and recorder equipped to readout 0–100% HC as propane (FID or NDIR types are recommended); 1 pressure sensor, transducer, and recorder.
5[1]	1 gas volume meter in vapor return line (3 cfm); 1 gas volume meter and vapor pump in leak check vapor line (see Figure 4).
1	1 gas volume meter (3 cfm); 1 pressure-vacuum solenoid valve system (Figure 3); 1 total hydrocarbon analyzer and recorder equipped to readout 0–100% HC as propane (FID or NDIR types are recommended).
2	1 flexible thermocouple with readout (0–100° F range); 1 gasoline sample thief (ASTM D–270).

[1] Equipment indicated is required at each pump being tested.

6.3 *Stage I operations at vacuum assisted systems.*

6.3.1. *Basic measurements required are described below.* Referring to Figure 2, the sample points are numbered. The measurements indicated provide for the inclusion of the secondary control device efficiency. These are not required to determine compliance with an applicable subpart if it can be shown through volume measurements, that the secondary control device is not needed to comply with the respective subpart.

Sample Point	*Measurements Necessary*
1 (inlet to control device).	Hydrocarbon concentration.
2 (exhaust vent of control device).	Volume of exhaust vapors; hydrocarbon concentrations.
3 (underground tank vent).	Check for hydrocarbon vapor leaks.
4 (underground tank).	Temperature of liquid (optional); volume of liquid.
5 (tank of bulk delivery truck).	Temperature of liquid (optional); pressure (optional); check for hydrocarbon vapor leaks at all connections.

6.3.2 *The equipment required for the basic measurements are listed below.* Alternative equipment may be used subject to the approval of the Administrator.

Sample point	*Equipment and specifications*
1	1 Total hydrocarbon analyzer with recorder equipped to readout 0–100% HC as propane (FID or NDIR types are recommended).
2	1 Volume dry gas meter (size depends on flow rate); 1 total hydrocarbon analyzer with recorder equipped to readout 0–100% HC as propane (FID or NDIR types are recommended).
3	Plastic bags (1–5 ft^3).

Sample point	Equipment and specifications
4	1 Flexible thermocouple with readout (range 0–100° F).
5	1 Flexible thermocouple with readout (range 0–100° F); 1 0–10" H_2O manometer; combustible gas detector (0–100% LEL).
	1 Total hydrocarbon analyzer with recorder equipped to readout 0–100% HC as propane (FID or NDIR types are recommended).

6.4 *Stage II operations at vacuum assisted systems.*

6.4.1 *Basic measurements required are described below.* Referring to Figure 2, the various sampling points in the system are numbered.

Sample point	Measurements necessary
6 (Dispensing nozzle).	Temperature of vehicle tank gasoline prior to refueling (optional); check for gasoline vapor leaks around nozzle-fillneck interface during refueling with combustible gas detector; hydrocarbon concentration of returned vapors; temperature of dispensed liquid (optional); temperature of returned vapors (optional).
7 (Vapor return line).	Volume of returned vapors; pressure in vapor return line (optional).
8 (Gas meter and pump).	Volume of gasoline dispensed during test period; volume of gasoline dispensed for each vehicle used during test.
1 (Inlet to secondary control device).	Volume of gasoline vapors returned to control device; hydrocarbon concentration of inlet vapors.
2 (Exhaust vent of control device).	Volume of exhaust vapors; hydrocarbon concentration of exhaust gases.
3. (Underground tank vent).	Check for gasoline vapor leaks.
4 (Underground tank).	Temperature of liquid in underground tank (optional); volume of liquid; sample for Reid vapor pressure analysis.

6.4.2 *The equipment required for the basic measurements are listed below.* Alternative equipment may be used subject to the approval of the Administrator.

Sample point	Equipment and Specifications
6	3 Flexible thermocouples (range 0–150° F) and recorders; 1 portable combustible gas detector (at least 0–100% lower explosive limit); 1 total hydrocarbon analyzer with recorder equipped to readout 0–100% HC as propane (FID or NDIR types are recommended).
7	1 Volume dry gas meter (size depends on flow rate).
1	1 Volume dry gas meter (size depends on flow rate); 1 total hydrocarbon analyzer and recorder equipped to readout 0–100% HC as propane (FID or NDIR types are recommended).
2	1 Volume dry gas meter (size depends on flow rate); 1 total hydrocarbon analyzer and recorder equipped to readout 0–20% HC as propane (FID or NDIR types are recommended).
3	Plastic bags (1–5 ft^3).
4	1 flexible thermocouple and readout (range 0–100° F); 1 gasoline sample thief (ASTM D–270).

7. *Test procedures.*

7.1 Stage I operations at vapor balance systems.

7.1.1 Preparations for the testing include the following:

7.1.1.1 On the exhaust vent of the underground tank connect a dry gas meter.

7.1.2 Measurements and data required for evaluating the bulk tank truck drop include the following:

7.1.2.1 Record the temperature of the liquid in the bulk tank of the truck (optional).

7.1.2.2 Attach a 0–10" H_2O manometer to the vapor return manifold on the truck so as to monitor and record the pressure inside the tank during the drop (optional).

7.1.2.3 Record the temperatures (optional) and volumes of the liquid in the underground tanks that are to receive the gasoline delivery.

7.1.2.4 Record the time (optional) required for the drop and record the volume of liquid transferred.

7.1.2.5 During the transfer monitor all hose connections with the combustible gas detector and record any incidents of leaks. Record any incidents of spillage and estimate amounts.

7.1.2.6 Record any volume vented from the underground tank vent.

7.1.2.7 During the gasoline transfer, record the pressure inside the tank of the bulk delivery truck (optional).

7.1.2.8 Ten minutes after transfer hoses are disconnected, record volumes and temperatures (optional) of the underground tanks. Record volume indicated by tank dipstick and by truck drivers manifest. Values should agree within ±2%.

7.1.2.9 Record the volume of gasoline dispensed to vehicles during the bulk gasoline transfer.

7.1.2.10 Record the ambient temperature and pressure. Ambient temperature shall be measured with an aspirated thermometer.

7.2 *Stage II operations at vapor balance systems.*

7.2.1 Preparations for the testing include the following:

7.2.1.1 Connect a gas volume meter into the vapor return line (sample point 5 on Figure 1). If necessary, connect a liquid trap upstream of the volume meter in the vapor return line. To the outlet side of the gas volume meter, attach a thermometer (0–150° F range).

7.2.1.2 Upstream of the gas volume meter in the vapor return line place a flow shut-off valve and a Tee-pipe fitting of the same size or larger as the I.D. of the vapor return hose. To the remaining leg of the Tee fitting connect a flow control valve, a gas volume meter and a propane source. Make all connections leak-tight. (See Figure 4 for equipment arrangement.)

7.2.1.3 Between the hoses and the dispensing nozzle (sample point 4 on Figure 1) place a connector that allows for the insertion of a thermocouple in the liquid dispensing line. This must be leak-tight. A similar thermocouple connection in the vapor return line is optional. A second tap in the vapor return line connection for a sample hose is necessary for the THC analyzer, and recorder. The size and weight of these manifolds, connectors and sample lines should be kept to a minimum in order to minimize any effect such equipment may have on nozzle collection efficiency.

7.2.1.4 Attach flexible thermocouples so that the dispensed gasoline temperature and the returned vapor temperature (optional) are detected. Connect these thermocouples to recorders so that records of the temperatures are kept during refueling.

7.2.1.5 Connect to the second tap in the vapor return hose nozzle connection a sample line for a total hydrocarbon analyzer.

7.2.1.6 The dispensing nozzle is to be modified also as to allow measurement of the static pressure at the nozzle-fillneck interface. This pressure tap should be placed no farther than 0.5 inch from the point at which the nozzle vapor recovery seal meets the vehicle fillneck and is to be placed upstream (on the vehicle tank side) of this interface. The tap shall not interfere with the flow of vapors into the vapor return nozzle. A pressure transducer and recording instrument should be connected. The addition of the pressure tap to the nozzle may be completed prior to the required 90-day reliability period as at the beginning of the test period. In either case, no seals, boots, or other nozzle parts directly involved in the collection of displaced vapors shall be replaced on the dispensing nozzle prior to the vehicle refueling test period.

7.2.1.7 At the outlet of the underground vent (sample point 1 on Figure 1) connect a pressure sensitive solenoid valve system (Figure 3) that routes in-breathing and out-breathing through different ports. Arrange pressure switches so that one opens one solenoid valve at a negative pressure and the other pressure switch opens another valve at a positive pressure. These pressures should be equal and each less than 0.1 inches of water. On the out-breathing port of this valve connect a gas volume meter with a tap on the outlet side for a total hydrocarbon analyzer sample. Connect the THC analyzer and recorder.

7.2.1.8 Calibrate and span all instruments according to the steps outlined in section 9.

7.2.1.9 On each day of the testing record initial and final volume readings from all pumps at the service station. Record initial and final underground tank temperatures (optional) and volumes. The total volume shown dispensed on the dispensers and the volume difference indicated by initial and final underground tank readings must agree within ±5%. If agreement cannot be attained or the reason for disagreement not determined, the test may be voided. (Sample points 6 and 2 on Figure 1.)

7.2.1.10 At the beginning of the testing period determine the liquid flow rate of the

nozzles to be used in the testing in each of the latched positions. This shall be done by pumping at least 10 gallons of gasoline in each latched position and recording the amount of gasoline pumped and the elapsed times for the pumping. This determination shall be performed at a time when no other test product dispensers at the station are being operated. The gasoline should be dispensed into a container that allows the dispensing nozzle to be latched into position allowing the return of gasoline vapors into the control system. Disturbance of the control system balance by dispensing gasolines without vapor return and allowing ingestion of air at the underground tank vent should be avoided.

7.2.1.11 At the beginning of the testing period and every hour during the testing period, record the ambient temperature and pressure. Ambient temperature shall be measured with an aspirated thermometer shielded from the radiation effects of sunlight.

7.2.1.12 At the beginning of the test period, obtain a gasoline sample from the underground tank under test according to procedure outlined in ASTM D–270, part 27. Have the sample analyzed to determine Reid Vapor Pressure according to ASTM D–323.

7.2.2 Procedures, measurements, and data required for each vehicle used for the vehicle refueling test include the following:

7.2.2.1 Record license number, State of registration, make, model, and year of each car tested.

7.2.2.2 Measure and record the temperature of the gasoline in the tank of the vehicle. Care must be taken to assure that the liquid temperature, not the vapor space temperature, is determined. A device consisting of a stiff 3 or 4 foot tygon tube and a squeeze bulk works well for this. The thermocouple is located in one end of the tube and the squeeze bulb on the other end. For measurements, the thermocouple end of the tube is inserted into the vehicle tank. The squeeze bulb is then used to draw liquid into the tube; visible inspection assures that the tube and thermocouple are inserted into the liquid.

7.2.2.3 Insert the gasoline dispensing nozzle into the vehicle fillneck so that the nozzle is latched into position and refueling can be performed in a hands-off mode. With the dispensing pump turned off, preset the dispensing nozzle handle to the desired dispensing rate position.

7.2.2.4 Prior to refueling, open the vapor line shut-off valve and close tightly the flow control valve (See Figure 4). Record the initial return vapor line gas volume meter reading. Begin dispensing by turning the dispenser on.

7.2.2.5 During the refueling operation, continuously record the hydrocarbon concentration of the vapors returning through the dispensing nozzle, the temperature of the dispensed liquid, and the static pressure at the nozzle-fillneck interface (at least every 15 seconds). At intervals of 5.0 gallons dispensed liquid volume, record the return vapor gas volume meter reading (optional).

7.2.2.6 During refueling check around the vehicle fillneck-nozzle interface with the combustible gas detector, the sample inlet held approximately 1 cm from the interface. Explore with the sample probe the entire periphery during the complete refueling operation. Record any incidents of detectable leaks of hydrocarbon vapors.

7.2.2.7 After the automatic shut-off of the dispensing nozzle or completion of a partial filling operation (more than 10 gallons, but less than a fill-up), record the gallons of gasoline dispensed and the final volume reading of the gas volume meter. Record the temperature of the returned vapor at the outlet side of the gas volume meter.

7.2.2.8 After the completion of liquid dispensing, leave the dispensing nozzle in place on the vehicle fillneck. Close tightly the vapor line shut-off valve (See Figure 4). Open the propane source in the leak rate system and adjusts the flow control valve until the static pressure at the nozzle-fillneck interface is 2.0" H_2O (inches of water). A vapor leak is indicated by movement of the gas volume meter for leak measurement. Should a leak exist, record a leak volume and a time interval of no less than 0.1 ft^3 (cubic feet) or 1.0 minute, whichever is greater. Determine a leak rate while maintaining the 2.0" H_2O pressure at the nozzle-fillneck interface. Repeat the above steps for pressure of 1.0, 0.5, and 0.1" H_2O. Should no leak exist at 2.0" H_2O pressure, record the fact and continue to step 7.2.2.9.

7.2.2.9 Turn off the dispensing pump, remove the dispensing nozzle from the vehicle fillneck and proceed to the next vehicle.

7.3 *Stage I operations at vacuum assisted systems.*

7.3.1 Preparations for testing include the following:

7.3.1.1 Where possible, connect to the exhaust vent of the control device (sample point 2 of Figure 2) a gas volume meter. In cases where extreme temperatures or other conditions (see paragraph 7.3.2.13) prohibit use of a gas volume meter on the exhaust vent, connect a volume meter into the system so as to obtain a volume measurement of the gas to be processed by the control equipment.

7.3.1.2 Connect to the exhaust vent of the control system a THC analyzer and recorder capable of measuring 0–20% HC as propane. For those systems with a volume measurement of process equipment inlet gas connect a second THC analyzer and recorder at the point of the volume measurement. Attach a temperature sensor so as to obtain a sample gas temperature.

7.3.1.3 Over any underground vent with or without a pressure-vaccum valve, attach a plastic bag effectively capturing any leakage from the vent. (Sample point 3 of Figure 2)

7.3.2 Measurements and data required for evaluating the bulk tank truck delivery include the following:

7.3.2.1 Record the temperature of the liquid in the bulk tank of the truck. (optional)

7.3.2.2 Attach a 0–10" H_2O manometer to the vapor return manfold on the truck so as to monitor the pressure inside the tank during the delivery. (optional) (sample point 5 on Figure 2)

7.3.2.3 Record the temperatures and volumes of the liquid in the underground tanks that are to receive the gasoline delivery.

7.3.2.4 Record the time (optional) required for the drop and record the volume of liquid transferred. Compare the volume delivered as indicated by the tank truck driver's manifest and the volume measured with the dipstick. These values should agree within ±2%.

7.3.2.5 During the transfer monitor all hose connections with the combustible gas detector and record any incidents of leaks. Record any incidents or spillage and estimate amounts.

7.3.2.6 Record any volume vented from the control device and the corresponding THC concentration and temperature. For units with no vented volume measurement, record inlet gas volume, THC concentration, and temperature.

7.3.2.7 Record any volume vented from the vent of the control device and record the corresponding concentration.

7.3.2.8 During the gasoline transfer, record the pressure inside the tank of the bulk delivery truck. (optional)

7.3.2.9 After the transfer hoses are disconnected record volumes and temperatures (optional) of the underground tanks.

7.3.2.10 Record the volume of gasoline dispensed to vehicles during the bulk gasoline transfer.

7.3.2.11 Record any incidents of leakage from the vent outlet from the underground tank by noting filling of the bag over the vent. Estimate the volume and elasped time for the leakage.

7.3.2.12 Record ambient temperature and pressure. Ambient temperature shall be measured with an aspirated thermometer shielded from the radiation effects of sunlight.

7.3.2.13 Some secondary control systems may employ large diameter exhausts that will require other stack sampling techniques in order to determine flow rates and hydrocarbon concentrations.

7.4 *Stage II operations at vacuum assisted systems.*

7.4.1 Preparations for the testing include the following:

7.4.1.1 Connect into the vapor return line of each pump to be tested (sample point 7 on Figure 2) a gas volume meter. Attach a temperature sensor and recorder to the outlet of the gas volume meter.

7.4.1.2 Between the hoses and the dispensing nozzle (sample point 6 on Figure 2) attach a connector in the vapor return line for connection to a THC analyzer and recorder.

7.4.1.3 Attach to the vapor return line nozzle connection a sample line for a total hydrocarbon analyzer capable of measuring 0–100% HC as propane. The sample pump for the THC analyzer should draw no more than 300 cubic centimeters per minute of sample. Arrangements should be made so that the sample line may be disconnected from the vapor return line when no refueling is in progress.

7.4.1.4 Connect to the inlet to the secondary control system (sample point 1 on Figure 2) a dry gas flow meter. Determine approximately what the flow rate will be in this line and choose an appropriately sized meter. Attach a tap for sample hose on the outlet of the volume meter.

7.4.1.5 Connect to the tap a THC analyzer capable of measuring 0–100% HC as propane. The analyzer should be equipped with a recorder.

7.4.1.6 Connect to the exhaust vent of the secondary control device (sample point 2 of Figure 2) an appropriately sized dry gas flow meter. Attach a tap for a sample hose to the outlet of the volume meter.

7.4.1.7 Connect to the tap a THC analyzer with recorder capable of measuring 0–20% HC as propane.

7.4.1.8 Over any underground vent with or without a pressure vacuum valve, attach a plastic bag effectively capturing any leaks from the vent. (Sample point 3 of Figure 2)

7.4.1.9 Calibrate and span all instruments as outlined in Section 9.

7.4.1.10 At the beginning of the test period, obtain a gasoline sample from the underground tank under test according to ASTM D–270, part 27. Analyze the sample to determine the Reid Vapor Pressure according to ASTM D–323.

7.4.2 Measurements and data required for determining system emission rates during vehicle refueling include the following:

7.4.2.1 Record the temperature (optional) of the liquid in each underground tank as well as volume. (Sample point 4 on Figure 2.)

7.4.2.2. Each day of the test record the initial liquid volume readings on each pump at the service station at the beginning of the test. Each day, record the final liquid volume pump readings at the completion of the test day. The volumes dispensed indicated by pump reading and by dipstick read-

ings should agree within ±5%. If the underground tank is under pressure by the control system, make the appropriate correction in the dipstick reading.

7.4.2.3 Record the initial volume readings from the dry gas volume meters at the inlet and outlet of the secondary control device at the beginning of the test.

7.4.2.4 At the beginning of the testing period and each hour during the testing period, record the ambient temperature and pressure. Ambient temperature shall be measured with an aspirated thermometer shielded from the radiation effects of sunlight.

7.4.2.5 Record license number, State of registration, make, model (optional), and year of each car tested.

7.4.2.6 Measure and record the temperature of the gasoline in the tank of the vehicle (optional).

7.4.2.7 Prior to refueling record the initial dry gas meter reading.

7.4.2.8 Time the refueling operation so as to obtain the total time interval for dispensing gasoline (optional) and the total time interval that the nozzle is attached to the vehicle fillneck (optional).

7.4.2.9 After the refueling operation begins record the pressure in the vapor return line (optional).

7.4.2.10 During refueling, check around the vehicle fillneck-nozzle interface with the combustible gas detector with the sample inlet held approximately 1 cm from the interface. Explore with the sample probe the entire periphery during the complete refueling operation and at least ten seconds after shutoff. Record any incidents of detectable leaks of hydrocarbon vapors and the magnitude in terms of percent of lower explosive limit. Record the highest explosimeter reading (expressed as % LEL) which occurs for a duration of 10 seconds or more.

7.4.2.11 At the end of the refueling, record the volume of gasoline dispensed and the final volume reading on the dry gas meter. Record the average hydrocarbon concentration from the total hydrocarbon analyzer.

7.4.2.12 Record any incidents of spillback or spillage (as defined in any applicable subpart) and estimate amounts.

7.4.2.13 Monitor and record the HC concentration of vapors at the inlet and the outlet of the secondary control device. Keep a record of volume readings associated with any changes in HC concentration. Keep a record of process equipment operation in relation to dispensed gasoline volume. Process equipment emission monitoring must coincide with dispensing operation. That is, if the control system utilizes a vapor holding tank for storing vapors collected during dispensing, the process equipment testing must be continued until all vapors from the dispensing test period have been processed.

8. *Calculations*—8.1 Stage I operations at vapor balance systems.

8.1.1 Terminology.

C—Concentration of hydrocarbon (%/100 on propane).
E—Control efficiency (%).
M—Mass of hydrocarbons (g).
M/L—Mass of vapor per liquid volume (g/gal).
P—Pressure (in Hg).
T—Temperature (°F).
V—Volume (ft^3).
a—Atmospheric.
e—Vent exhaust from underground tank.
f—Final reading.
i—Initial reading.
k—Leak not measured.
l—Gasoline liquid.
m—Mass.
u—Underground tank.
v—Volume.
17.71 Temperature and pressure correction factor.

$$\left(\frac{°R}{\text{in. Hg}}\right)$$

51.6—Hydrocarbon fraction to mass density conversion factor (100 g/(scf %)).
460—Correction to Rankin degrees (° F).
7.481—Gallons per cubic foot (gal/ft^3).

8.1.2 Determine for the bulk loading evaluation:

8.1.2.1 The volume of hydrocarbon vapors exhausted from the underground tank vent line.

$$V_e = V_f - V_i + V_k$$

8.1.2.2 Volume of liquid dropped from the tank truck to the bulk tank during the test period $-V_l$. Compare the underground tank readings before and after the drop with the volume reported dropped. If an inconsistency occurs, take steps to correct the volume value.

8.1.2.3 Calculate the volume efficiency.

$$E_{vol} = 100\left[1 - 7.481\,\frac{V_e(T_u+460)}{V_l(T_a+460)}\right]$$

8.1.2.4 Assume that the concentration of hydrocarbon vapors emitted from the exhaust vent is the same as for the vapors returned to the tank truck so that the mass efficiency is:

$$E_{mass} = E_{vol}$$

8.1.2.5 Calculate standard vapor volume:

$$V_{es} = \frac{17.71\,V_e P_a}{T_a+460}$$

8.1.2.6 Mass exhausted:

$$M_e = 51.6\,V_{es} C_e$$

8.1.2.7 Mass emission rate:

$$M/L = M_e/V_l$$

8.2 *Stage II operations at vapor balance systems.*

8.2.1 Terminology:

C—Concentration of hydrocarbon (%/100 as propane).
L—Liquid volume (gal).
M—Mass of hydrocarbon (g).
M/L—Mass of vapor per liquid volume (g/gal).
P—Pressure (in Hg).
R—Dispensing rate (gal/min).
T—Temperature (° F).
V—Volume (ft^3).
a—Atmospheric.
b—Baseline.
d—Dispensed liquid.
e—Vent exhaust from underground tank.
f—Final reading.
i—Initial reading.
k—Leak at nozzle-fillneck interface.
l—Vapor loss.
m—Volume meter.
p—Leak pressure (in H_2O).
r—Returned vapor.
s—Standard condition (70° F, 29.92 in Hg).
t—Time interval (sec).
u—Underground tank.
v—Vehicle tank.
x—Total vapors exhausted.
7.481—Gallons per standard cubic foot (gal/scf).
17.71—Temperature and pressure correction factor (° R/in Hg).
51.6—Hydrocarbon fractions to mass density conversion factor [100 g/(scf %)].
460—Correction to Rankin degrees (° F).

8.2.2 Determine for all vehicles used for the testing.

8.2.2.1 Volume of returned vapors.

$$V_r = V_f - V_i$$

8.2.2.2 Volume to liquid ratio.

$$V/L = 7.481\,\frac{V_r}{V_d}$$

8.2.2.3 Dispensing rate.

$$R_d = \frac{V_d}{t}$$

8.2.2.4 Vehicle tank—dispensed liquid temperature difference.

$$\Delta T_{vd} = T_v - T_d$$

8.2.2.5 Standard returned vapor volume.

$$V_{rs} = \frac{17.71\,V_r P_a}{T_m+460}$$

8.2.2.6 Mass of hydrocarbon vapor returned.

$$M_r = 51.6\,V_{rs} C_r$$

8.2.2.7 Mass returned to volume dispensed ratio.

$$(M/L)_r = M_r/L_d$$

8.2.2.8 Volume leaked per interval time during leak test at the nozzle-fillneck interface.

V_k/t at each ΔP used for leak check.

8.2.2.9 Establish a leak rate versus pressure curve.

V_k/t versus ΔP

8.2.2.10 The leak rate versus pressure curve and the pressure measured during the fueling operation, the volume of vapor leaked to the atmosphere during refueling.

V_k

8.2.2.11 Standard leaked volume.

$$V_{ks} = \frac{17.71\,V_k P_a}{T_d+460}$$

8.2.2.12 Mass of hydrocarbon vapor leaked

$$M_k = 51.6\,V_{ks} C_r$$

8.2.2.13 Mass emitted per volume dispensed ratio.

$$(M/L)_e = M_k/L_d$$

8.2.3 Establish a potential emissions baseline curve as follows:

8.2.3.1 Identify the vehicles which were refueled with no vapor losses, as indicated by the explosimeter or by the leak test following the fueling operation. These vehicles are considered to be baseline vehicles.

8.2.3.2 For these vehicles establish a baseline curve of $(M/L)_r$ as the dependent variable and $T_v - T_d$ (ΔT_{vd}) as the independent variable. Other independent variables, such as fuel RVP and underground tank temperature, may be included in the relationship if this can be shown to provide a better correlation. These are considered optional. The curve shall be based on a least squares linear correlation. Non-linear regression correlations may be substituted if it can be shown that a greater degree of correlation can be obtained.

8.2.4 To determine the mass emission rate for vehicle refueling operations complete the following steps.

8.2.4.1 Using the baseline relationship established in 8.2.3 determine for each non-

baseline vehicle, a value for $(M/L)_r$ at the respective ΔT_{vd}. This will be $(M/L)_b$.

8.2.4.2 For each vehicle where $(M/L)_e$ from step 8.2.2.13 is greater than 1.0 g/gal, substitute the value for $(M/L)_b$ in place of $(M/L)_e$. That is:

$$(M/L)_e = (M/L)_b$$

8.2.4.3 Calculate a revised mass of hydrocarbon vapor emitted for each vehicle subject to 8.2.4.2.

$$M_k = L_d\,(M/L)_e$$

8.2.4.4 Determine the total volume of gasoline dispensed at the service station during the testing period. If the vapor recovery system is such that different gasoline products have separate vent lines, determine the dispensed volume only for the product or products used for the test. This value is L_m. Compare the daily underground tank volume readings with the daily pump volume readings. If an inconsistency occurs, determine the correct value. These values should agree within ±5%.

8.2.4.5 Calculate the mass of hydrocarbons lost through the vent line during the test period. Include any breathing losses while the station is closed if such losses occurred during the test period.

$$M_e = 51.6\ V_{es} C_e$$

8.2.4.6 Determine the average total hydrocarbon emission rate:

$$(M/L)_x = \frac{\sum M_k}{\sum L_d} + \frac{M_e}{L_u}$$

8.2.4.7 Determine the total number of vehicle fillings during which spitback was recorded. Report this number on the basis of number of spitback occurrences per 100 fillings.

8.3 *Stage I operations at vacuum assisted system.*

8.3.1 Terminology.

C—Concentration of hydrogen (%/100 as propane).
E—Control efficiency (%).
L—Liquid volume (gal).
M—Hydrocarbon mass (g).
P—Pressure (in Hg).
T—Temperature (° F).
V—Volume (ft^3).
a—Atmospheric.
d—Liquid delivered.
e—Exhaust gas.
f—Final reading.
i—Initial reading.
k—Vapor leak.
r—Vapors entering control system.
s—Standard conditions (70° F and 29.92 in. Hg).
17.71—Temperature and pressure correction factor (° R/in. Hg).
51.6—Hydrocarbon fraction to mass density conversion factor [100 g/(scf %)].
460—Correction to Rankin degree (° F).
0.145—Hydrocarbon mass per volume—concentration correction factor (g/g).

8.3.2 Determine the following for the bulk loading evaluation.

8.3.2.1 Volume of exhausted hydrocarbon vapors from the secondary process equipment.

$$V_e = V_f - V_i$$

8.3.2.2 Standard volume of exhaust gas.

$$V_{es} = \frac{17.71\ V_e P_a}{T_a + 460}$$

8.3.2.3 Mass of exhausted hydrocarbons.

$$M_e = 51.6\ (V_e C_e + V_k C_r)$$

NOTE.—V_k is an estimate of the volume of vapors leaked from points in the control system other than from the exhaust vent. Some of these can be measured directly with volume meters or calibrated bags.

8.3.2.4 Determine the total volume of gasoline delivered during bulk loading.

$$L_d$$

8.3.2.5 Calculate the mass emission rate (optional).

$$(M/L)_e = \frac{M_e}{L_d}$$

8.3.2.6 Calculate mass efficiency.

$$E_{mass} = \left[1 - 0.145\ \frac{M_e}{L_d C_r}\right]$$

8.4 *Stage II operations at vacuum assisted control system.*

8.4.1 Terminology.

C—Concentration of hydrocarbons (%/100 as propane).
E—Control efficiency (%).
L—Liquid volume (gal).
M—Hydrocarbon mass (g).
M/L—Mass of vapor per liquid volume (g/gal).
P—Pressure (in. Hg).
R—Explosimeter reading (%/100 LEL).
T—Temperature (° F).
V—Vapor volume (ft^3).
a—Atmospheric.
d—Dispensed liquid.
e—Exhaust vent emissions.
f—Final reading.
i—Initial reading.
k—Leak at nozzle-fillneck interface.
m—Volume meter in vapor return line.
o—Excess vapor.
p—Process equipment inlet.
r—Returned vapor.
s—Standard conditions (70° F, 29.92 in. Hg).
t—Total dispensed liquid.
u—Underground tank.
v—Total returned vapor.
x—Total vapors emitted to atmosphere.
17.71—Temperature and pressure correction factor (° R/in. Hg).
460—Correction to Rankin degrees (° F).
51.6—Hydrocarbon fraction to mass density conversion factor (100 g/scf %).
6.90—Hydrocarbon fraction to mass density conversion factor (100 g/gal %).

8.4.2 Determine the following variables for vehicle refueling evaluation.

8.4.2.1 Volume of vapors returned for each vehicle used during the test period.

$$V_r = V_{rf} - V_{ri}$$

8.4.2.2 Standard volume of returned gases for each automobile.

$$V_{rs} = \frac{17.71\ V_r P_a}{T_a + 460}$$

8.4.2.3 Mass of returned vapor for each automobile.

$$M_r = 51.6\ V_{rs} C_r$$

8.4.2.4 For those vehicle fillings that had explosimeter readings of 10 seconds duration or longer in excess of 0.1 LEL, the following table, Table 8–1, is to be used to estimate the leakage volume, V_k for each vehicle.

TABLE 8–1

Maximum explosimeter reading:	Leakage volume
R	V_k (gal)
R<0.1 LEL	0
0.1 LEL≤R<0.5 LEL	0.10 L_d
0.5 LEL≤R<1.0 LEL	0.35 L_d
1.0 LEL≤R	1.50 L_d

8.4.2.5 Calculate the estimated hydrocarbon mass leakages for each vehicle.

$$M_k = 6.90\ V_k C_r$$

8.4.2.6 Sum the estimated hydrocarbon mass leakages.

$$\Sigma M_r$$

8.4.2.7 Mass per volume of liquid for each automobile.

$$(M/L)_r = \frac{M_r}{L_d}$$

8.4.2.8 Average $(M/L)_r$.

$$(M/L)_r = \frac{\sum M_r}{\sum L_d}$$

8.4.2.9 Volume of vapors flowing to inlet of control device.

$$V_p = V_{pf} - V_{pi}$$

8.4.2.10 Standard volume of vapors flowing to processing equipment.

$$V_{ps} = \frac{17.71\ V_p P_m}{T_m + 460}$$

8.4.2.11 Mass of vapors at inlet of processing equipment.

$$M_p = 51.6\ V_{ps} C_p$$

8.4.2.12 Total volume of liquid dispensed during test period from dispenser readings and underground tank measurements.

$$L_t$$

8.4.2.13 Mass per volume of liquid at inlet of processing equipment.

$$(M/L)_p = \frac{M_p}{L_t}$$

8.4.2.14 Volume of exhausted gases from control system.

$$V_c = V_{cf} - V_{ci}$$

8.4.2.15 Standard volume of exhausted gases.

$$V_{cs} = \frac{17.71\ V_c P_a}{T_a + 460}$$

NOTE.—If the temperature and/or pressure of the gas meter at the exhaust of the processing equipment is substantially different from ambient conditions, substitute the proper values for P_a and T_a.

8.4.2.16 Mass of exhausted vapors.

$$M_c = 51.6\ V_{cs} C_c$$

8.4.2.17 Mass emitted per volume of liquid dispensed:

$$(M/L)_e = M_e/L_t$$

8.4.2.18 Volume of vapors returned per volume of liquid dispensed average:

$$\overline{(V/L)}_r = \frac{\sum V_r}{\sum L_d}$$

8.4.2.19 Total volume of vapors returned from all pumps during test period:

$$V_v = L_t\ (V/L)_r$$

8.4.2.20 If the vapor recovery system uses the underground tanks as holding tanks for some of the collected vapor, calculate the volume excess to be processed:

$$V_{po} = V_v - 0.1337\ L_t$$

If all the vapors collected during refueling operations are processed by the control system—

$$V_{po}=V_s$$

8.4.2.21 Compare V_p and V_{po}.

If $V_{po}>V_p$, substantial leaks may exist in the control system or in the underground piping. If V_{po} exceeds 1.2 V_p, the test results shall be considered invalid.

8.4.2.22 Efficiency of processing equipment (optional).

$$E_p=100\,\frac{(M/L)_e}{(M/L)_r}$$

8.4.2.23 Determine the total number of vehicle fillings during which spitback was recorded. Report this number on the basis of number of spitback occurrences per 100 fillings.

8.4.2.24 Mass emission rate.

$$(M/L)_x=\frac{M_e}{L_t}+\frac{\Sigma M_k}{\Sigma L_d}$$

9. *Calibrations and Specifications.* The following calibration procedures shall be performed and records documentation and the calibration shall be made and retained.

9.1 *Volume meters.* A minimum of five (5) flow rates shall be run during calibrations of volume meters and the flow rates shall be in the range of flow rates expected during testing. A wet test meter shall be used as the standard. For meters used in the vapor return lines of balance control systems the recommended flow rates are 0.3, 0.6, 0.8, 1.2, 1.5 standard cubic feet per minute. The maximum pressure drop from the inlet to the outlet of the volume meter during the calibrations shall be 0.05 inches of water. When installed in the vapor return hose for testing it is suggested that a somewhat larger diameter hose be used in place of the hose supplied with the vapor control equipment. The combination of larger hose and low back-pressure meter should induce no more back-pressure in the system than the standard vapor return hose by itself. It is suggested that a rotary positive displacement volume meter (such as the model 3M125 Dresser Roots meter) modified with photoelectric readout precision of ± 0.01 ft³ be used. For this application the lubricant should be removed in order to reduce to a minimum the resistance to gas flow.

9.2 *Temperature measurement instruments.* Bimetallic thermocouples or thermisters are acceptable and should be checked for linearity prior to testing with a good mercury thermometer. During the test period, the instruments should be spanned three times daily using ice water (32° F) and a known source of about 100° F.

9.3 *Pressure gauges.* Electronic pressure transducers, magnetic gauges or inclined water manometers are acceptable. The pressure transducers and magnetic gauges should be calibrated at the test site to determine linearity across the range of pressures expected during the tests. A good inclined water manometer shall be used as the standard and the instruments shall be readable to within ± 0.01 inches of water.

9.4 *Total hydrocarbon analyzers.* Flame ionization detectors or non-dispersive infrared analyzers are acceptable for measurement of total hydrocarbon concentrations. Calibrations should be performed following the manufacturer's instructions for warm-up time and adjustments. Calibration gases should be propane in nitrogen of known concentrations prepared gravimetrically with measured mass quantities of ~100% propane. A calibration curve shall be produced using a minimum of five (5) prepared calibration gases in the range of concentrations expected during testing. The calibration curve shall be used in determining measured levels from tests. The calibration of the instruments need not be performed on site, but shall be performed prior to and immediately following the test program. During each test day, the hydrocarbon instruments shall be spanned on site with zero gas (<3 ppm C) and with a known concentration of propane in nitrogen at a level near the highest concentration expected at the test point. The spanning procedure shall be performed at least once prior to the first test measurement, once during the middle of the test period, and once following the final test measurement on each test day.

Conditions in calibration gas cylinders must be kept well below critical pressures and temperatures in order to avoid condensation of propane and affecting the gas concentration. A safety factor of at least two is recommended.

Sample flow rates to the hydrocarbon analyzer must be kept to a minimum. It is recommended that sample flow to an instrument that destroys the sample (an FID) be less than 0.3 lpm (liters per minute). For an instrument which does not alter the characteristics of the gas sample (NDIR), the sample should be reintroduced to the vapor control system prior to the appropriate volume meter.

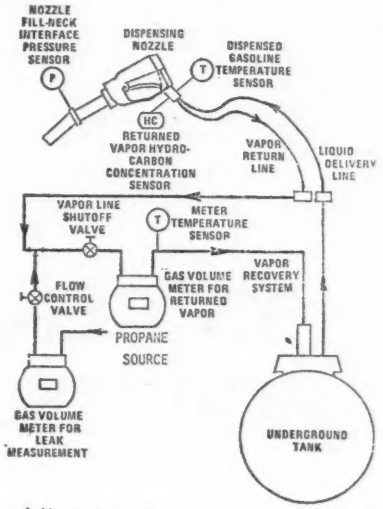

Figure 4. Vapor volume and mass measurement system for stage II vapor balance systems.

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